



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

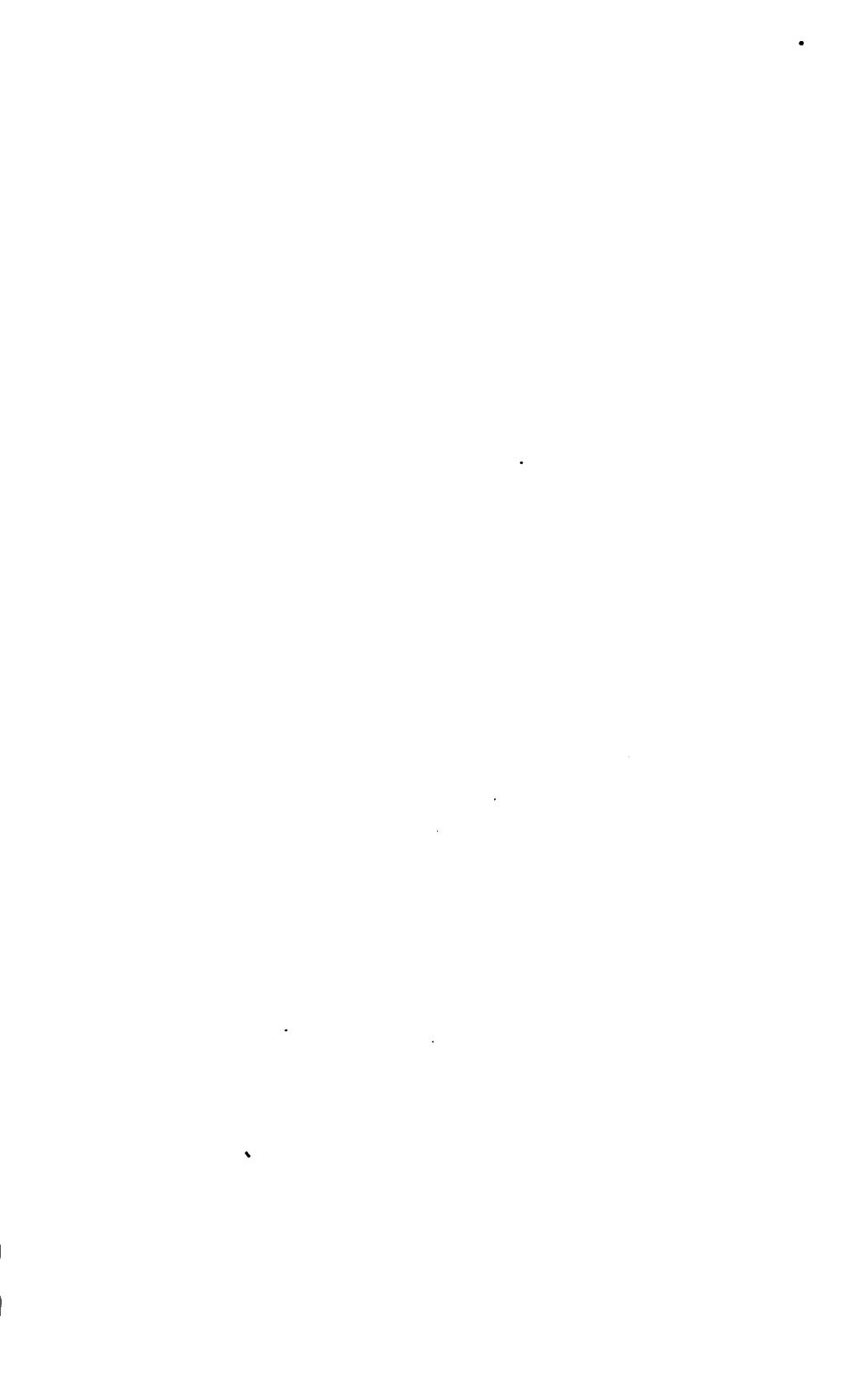
C.

Soc. 18854 d 17



C.

Soc. 18854 d 17



TRANSACTIONS

OF THE

Epping Forest and County of Essex

NATURALISTS' FIELD CLUB.

VOLUME I.

(January 10th, 1880, to January 22nd, 1881.)

*(The Authors only are responsible for the statements and opinions
contained in their respective papers.)*

PUBLISHED BY THE CLUB.

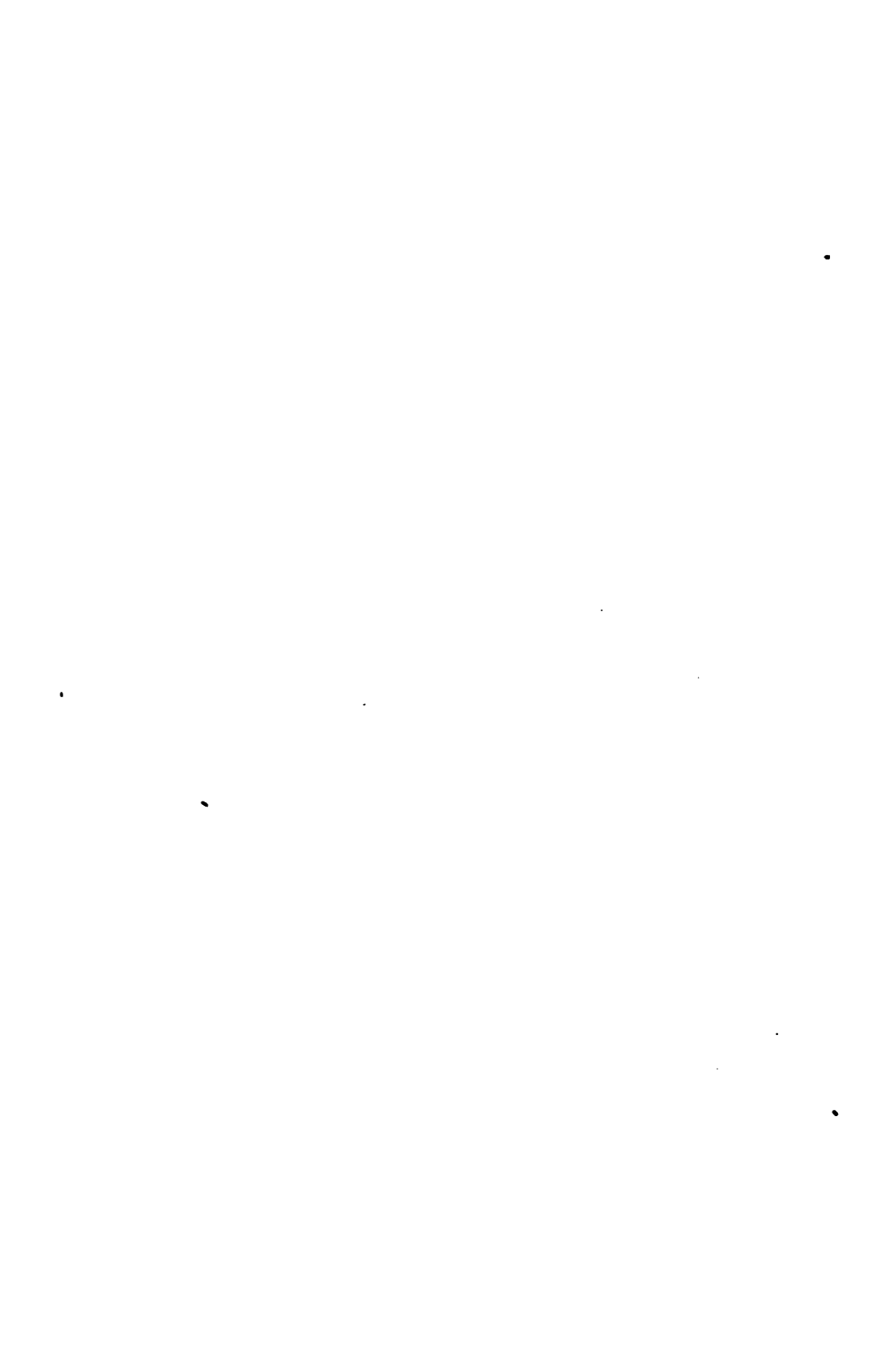
BUCKHURST HILL, ESSEX.

1881.

PRINTED BY
James Jones, "Woodford Times" Office.

CONTENTS.

	Page.
I.—The President's Inaugural Address—by Raphael Meldola F.R.A.S., F.C.S., &c.	3
II.—A Day's Elephant Hunting in Essex—by Henry Walker, F.G.S.	27
III.—On the Occurrence of the Great Bustard (<i>Otis tarda</i> , L.) and of the Rough-legged Buzzard (<i>Buteo lagopus</i> , Gm.), near Chelmsford, during the Winter of 1879—by R. M. Christy.	59
IV.—Note on an Abnormal Form of <i>Cardamine pratensis</i> , L. observed near Chelmsford—by John Gibbs.	64
V.—Natural History Notes—by R. M. Christy ..	66
VI.—Two Notes on the Preservation of Plants with their Natural Colours and Forms—by James English.	71
VII.—Forest Animals—by J. E. Harting, F.L.S., F.Z.S., &c.	74
VIII.—The President's Annual Address—by Raphael Meldola, F.R.A.S., F.C.S., &c.	97
Proceedings	i—lxxii
Index	lxxii
Errata	lxxv



The Epping Forest & County of Essex NATURALISTS' FIELD CLUB.

LIST OF MEMBERS.

PATRON.

H.R.H. THE DUKE OF CONNAUGHT & STRATHEARN, K.G.
(*Ranger of Epping Forest*).

Officers,

Elected January 22nd, 1881.

President.

RAPHAEL MELDOLA, F.R.A.S., F.C.S., &c.
Vice-President of Entomological Society.

Vice-Presidents.

J. T. CARRINGTON, F.L.S. (*Naturalist, Royal Aquarium*).
EDWARD A. FITCH, F.L.S.
N. F. ROBERTS, F.G.S. Rev. W. LINTON WILSON, M.A.

Other Members of Council.

WILLIAM J. ARGENT.	GEORGE C. HARCOURT.
EDWARD B. AVELING,	FRANCIS G. HEATH.
D.Sc., F.L.S., &c.	J. P. HORE.
RICHARD L. BARNES, F.C.S.	ANDREW JOHNSTON, <i>High</i>
W. C. BARNES.	<i>Sheriff, (Verderer, Epping</i>
E. N. BUXTON, J.P., &c.	<i>Forest).</i>
(<i>Verderer Epping Forest</i>).	REV. T. W. PEILE.
ROBERT M. CHRISTY.	NATHANIEL POWELL,
B. G. COLE.	J.P., &c.
PATRICK COPLAND.	HILDEBRAND RAMSDEN,
REV. JAMES FRANCIS, M.A.	M.A., F.L.S., F.R.M.S., &c.
GEORGE J. GODWIN.	W. G. S. SMITH.
HERBERT GOSS, F.L.S.,	CHARLES THOMAS, F.G.S.
F.G.S., &c.	T. FISHER UNWIN.

Treasurer.

H. J. BARNES, F.C.S., (*Berlin*), *Oak Hall, Buckhurst-hill*
Essex.

Secretary.

WILLIAM COLE, M.E.S., *Laurel Cottage, Buckhurst-hill,*
Essex.

Librarian.

ALFRED LOCKYER, *Tavistock-road, Snaresbrook, Essex.*

JANUARY, 1881.

Head Quarters of Club:

3, ST. JOHN'S TERRACE, BUCKHURST HILL,

LIST OF MEMBERS.

(Corrected to January 22, 1881.)

Patron.

H.R.H. THE DUKE OF CONNAUGHT AND
STRATHEARN, K.G.,

RANGER OF EPPING FOREST.

Honorary Members.

Date of Election.

- Jan. 10, 1880. BROWNE, CHARLES, M.A., Barrister-at-law,
2, Stone-buildings, Lincoln's-inn, W.C.
- „ 22, 1881. COOKE, M. C., M.A., LL.D., A.L.S., 146,
Junction-road, N.
- „ 10, 1880. DARWIN, CHARLES, M.A., LL.D., F.R.S.,
L. and E. F.L.S., F.G.S., &c., Down,
Beckenham, Kent.
- „ 22, 1881. HARTING, J. E., F.L.S., F.Z.S., 22, Regent's-
park-road, N.W.
- „ „ PITT-RIVERS, Major-General, F.R.S., 19,
Penywern-road, South Kensington, W.
- „ „ SMITH, WORTHINGTON G., F.L.S., 125,
Grosvenor-road, Highbury, N.
- „ „ WALKER, HENRY, F.G.S., 6, Oakington-
road, St. Peter's-park, W.
- „ 10, 1880. WALLACE, ALFRED RUSSEL, F.L.S., F.Z.S.,
Pen-y-bryn, St. Peter's-road, Croydon.
- „ „ WHITAKER, WILLIAM, B.A., F.G.S., &c.,
Her Majesty's Geological Survey, Jer-
myn-street, S.W.

Ordinary Members.

*(Original Members, registered under Rule VI., are denoted by an *; Life Members are indicated by a †. Where no county or postal letter is added, Essex is understood.)*

Date of Election.

- * ADAMS, HERBERT, J., Roseneath, London-road, Enfield, N.
- May 29, 1880. ALCOCK (Miss), The Hall, Sunnyside, Chingford.
- * ALCOCK (Miss), Ada, The Hall, Sunnyside, Chingford.
- * ALLEN, WILLIAM, at 3, Liverpool-terrace, Canning Town, E.
- * ARGENT, W. J., Nightingale-villas, Wanstead.
- * AVELING, EDWARD B., D.Sc., F.L.S., &c., Royal Polytechnic, Regent-street, W.
- * BABINGTON, C. C., M.A., F.R.S., F.L.S., F.G.S., &c. (*Professor of Botany, University of Cambridge*), 5, Brookside, Cambridge.
- * BARCLAY (Mrs.), H. F., Woodford.
- * BARNES, CHARLES E., Oak Hall, Buckhurst-hill.
- * BARNES (Miss), Clara, Oak Hall, Buckhurst-hill.
- * BARNES, HENRY J. (*Hon. Treasurer*), Oak Hall, Buckhurst-hill.
- Jan. 22, 1881. BARNES (Mrs.), Oak Hall, Buckhurst-hill.
- * BARNES, R. L., F.C.S., Oak Hall, Buckhurst-hill.

Date of Election.

- * BARNES, W. C., Oak Hall, Buckhurst-hill.
- * BARNETT (Miss), Melrose Villa, Buckhurst-hill.
- * BENTON, GEORGE A., Yarra Villa, Princes-road, Buckhurst-hill.
- * BILLUPS, T. R., M.E.S., 4, Swiss-villas, Coplestone-road, Peckham, S.E.
- June 26, 1880.* BODLE, WILLIAM, Palmerston-road, Buckhurst-hill.
- Jan. 22, 1881.* BOLTON, Rev. W. J., M.A., St. John's, Stratford.
- * BOSCHER, E., M.E.S., Bellevue House, Twickenham.
- June 26, 1880.* BOULGER, Professor G. S., F.L.S., F.G.S., 144, Kensington-park-road, W.
- * BRADY, Sir ANTONIO, F.G.S., J.P., &c., (*Verderer of Epping Forest*), Maryland Point, Stratford.
- * BROOK, GEORGE (Ter.), F.L.S., Fernbrook, Huddersfield.
- * BROOKE, ARTHUR, Carisbrooke, Muswell-hill, N.
- Jan. 22, 1881.* BROOKE, EDWARD, D.L., J.P., &c., Caen Wood Towers, Highgate, N.
- Nov. 27, 1880.* BROOKE, GEORGE, Beech Hall, Hale End, Walthamstow.
- * BROWNE, COLVILL, 5, Hilldrop-road, Camden-road, N., and Scientific Club, Savill-row, W.
- * BURNEY, GEORGE, Millwall, E.
- * BURROWS, JOHN, Wanstead.
- * BUXTON, E. N., J.P., &c., (*Verderer of Epping Forest*), Knighton, Woodford.
- * BUXTON, Sir T. Fowell, Bart., J.P., &c., (*Verderer of Epping Forest*), Warlies, Waltham Abbey.
- * BUXTON, T. F. V., Warlies, Waltham Abbey.

Date of Election.

- * CANSDALE, W. D., M.E.S., Guithavon-terrace, Witham.

Aug. 28, 1880. CARLINGFORD, The Right Hon. Lord, Dudbrook House, Navestock.

- * CARRINGTON, JOHN T., F.L.S., M.E.S. (*Vice-President*), Royal Aquarium, Westminster S.W.

- * CHALLIS, A. F., The Chestnuts, Buckhurst-hill.

Dec. 18, 1880. CHILTON, HENRY C., Woodford.

„ „ CHRISTIAN, WALTER T., 2, Eaton-villas, Loughton.

- * CHRISTY, ROBERT M., Chignal St. James, near Chelmsford.

- * CLAPHAM (Mrs.), A. H., Buckhurst-hill.

- * CLARKSON, JAMES A., 4, St. John's-terrace, Buckhurst-hill.

- * CLEGG, JOSEPH, M.R.C.S., Epping.

- * COLE, BENJAMIN G., Laurel Cottage, Buckhurst-hill.

- * COLE, HENRY A., Laurel Cottage, Buckhurst-hill.

- * COLE (Miss), Laurel Cottage, Buckhurst-hill.

- * COLE (Miss), JANE E., Laurel Cottage, Buckhurst-hill.

- * COLE, Rev. JOHN F., Roffey Vicarage, Horsham, Sussex.

(*Founder*) COLE, WILLIAM, M.E.S. (*Hon. Secretary*), Laurel Cottage, Buckhurst-hill.

- * COOPER, FRANK W., L.R.C.S. (Edin.), Gainsborough House, Leytonstone.

- * COOPER, JOHN D., The Hollies, Woodford Green.

Dec. 18, 1880. COPLAND, CHARLES, C.E., &c., The Park, Kingston-upon-Hull.

- * COPLAND (Mrs.), Hillcote, Buckhurst-hill.

Date of Election.

- * COPLAND, PATRICK, Hillcote, Buckhurst-hill.
- * COPLAND, P. F. (Junr.), M.E.S., Hillcote, Buckhurst-hill.
- * CORDER, HENRY, Grove House, Great Baddow.
- * CRISP, FRANK, LL.B., B.A., F.L.S., *Secretary to the Royal Microscopical Society* M.E.S., &c., 5, Lansdowne-road, Notting-hill, W.
- * CROUCH, Henry, F.R.M.S., &c., Grove-hill, Woodford.
- Aug.* 28, 1880. CROUCH, WALTER, Grafton House, Wellesley-road, Wanstead.
- Sept.* 25, 1880. CUTTING, WILLIAM M., Elm House, Loughton.
- * DEACON, OCTAVIUS, Golding's-hill, Loughton.
- * DEVITT, HENRY, Hillside, Buckhurst-hill.
- * D'OYLEY, WILLIAM (*Hon. Surveyor*), Loughton.
- * DUFFIELD, FREDERICK H., 78, Claverton-street, Pinlicko, S.W.
- *†DUNNING, J. W., M.A., F.L.S., F.Z.S., 12, Old-square, Lincoln's-inn, W.C.
- * DURRANT, W. G., Whitehall-road, Woodford.
- * EMERY, W. FRANCIS, 104, Liverpool-road, Islington, N.
- * ENGLISH, JAMES, Epping.
- Aug.* 28, 1880. ESSEX, The Right Hon. the Earl of, Cassio-bury Park, Watford, Herts.
- „ „ FAWCETT, WILLIAM, Fern Villa, Maybank-road, Woodford.
- May* 29, 1880. FINZI, JOHN, 105, Gower-street, W.C.
- * FISHER, LIONEL P., South Side, Harrow, Middlesex.

Date of Election.

- Aug.* 28, 1880. FISHER, WILLIAM R., M.A., Barrister-at-law, &c., South Side, Harrow, Middlesex.
- * FITCH, EDWARD A., F.L.S., *Secretary to the Entomological Society, &c.* (*Vice-President*), Brick House, Maldon.
 - * FORBES, WILLIAM P., Evergreen Lodge, Wanstead.
 - * FORSTER, WILLIAM, East Lenham Lodge, Cleveland-road, Wanstead.
 - * FOWLER, WILLIAM, J.P., &c., Forest House, Leytonstone.
 - * FRANCIS, REV. JAMES, M.A., Vicarage, Waltham Holy Cross.
 - * FRANCIS, WILLIAM, Ph.D., F.L.S., F.G.S., F.C.S., F.R.A.S., &c., Manor House, Richmond, Surrey.
- July* 24, 1880. FRISWELL, RICHARD J., F.C.S., F.I.C., &c., 10, Clapton-square, Lower Clapton, E.
- * GARDNER, SAMUEL, 5, Whitehall-lane, Buckhurst-hill.
 - * GARDNER, THOMAS, Oak Lea, Whitehall-road, Buckhurst-hill.
- May* 29, 1880. GAWLER, JOHN M., 2, Park-villas, Margery-park, Stratford.
- Aug.* 28, 1880. GEORGE, WILLIAM, 19, Church-crescent,* South Hackney, N.E.
- * GIBBS, JOHN, Writtle-road, Chelmsford.
- May* 29, 1880. GLASS, CHARLES J., Bocking House, Walthamstow.
- * GODWIN, GEORGE J., 4, St. John's-villas, Buckhurst-hill.
 - * GODWIN (Mrs.), 4, St. John's-villas, Buckhurst-hill.
 - * GOMM, WILLIAM H., Waltham Abbey.
 - * GORDON, FREDERICK, Ellerslie, Buckhurst-hill.
 - * GOSS, HERBERT, F.L.S., F.G.S., M.E.S., &c., The Avenue, Surbiton-hill, Surrey.

Date of Election.

- * GOULD, F. C., 10, Knighton-villas, Buckhurst-hill.
 - * GRIPPER, JOSEPH E., 35, High-street, Worcester.
 - * GRUT, FERDINAND, F.L.S., &c. (*Librarian to the Entomological Society*), 9, King-street, Southwark, S.E.
 - * HALSEY, WILLIAM, 8, Mornington-road, Woodford.
 - * HARCOURT, GEORGE C., 34, Wellesley-road, Wanstead.
 - * HARPER, AUGUSTUS, Lomsenheim, Cleveland-road, Wanstead.
 - * HART, F. G., Canes, near Harlow.
 - * HEATH, FRANCIS G., Brunswick Lodge, South Hackney, N.E.
- July 24, 1880.* HEATHFIELD, ERNEST, Snakes-lane, Woodford.
- * HENTY, ROBERT, Nazing Park, Waltham Cross.
 - * HODGE (Miss), CATHERINE L., Magdala House, Buckhurst-hill.
 - * HODGE (Miss), MARY, Magdala House, Buckhurst-hill.
 - * HODGE, SAMUEL W., Magdala House, Buckhurst-hill.
 - * HOOPER, BASIL M., 2, Albert-villas, Whitehall-road, Woodford.
 - * HOOPER, HORACE B., Roden House, Abridge.
 - * HORE, J. P., 7, Charlotte-street, Portland-place, W.
 - * HOWARD, DAVID, Rectory Manor, Walthamstow.
 - * HOWARD, JOHN ELIOT, F.R.S., F.L.S., &c., Lord's Meade, Tottenham, N.
 - * HOWARD, WILLIAM C., North Side, Tottenham, N.

Date of Election.

- * HOWARD, W. DILLWORTH, City Mills, Stratford.
- * HUTCHISON, JOHN, Fairlight, Palmerston-road, Buckhurst-hill.
- * HUTCHISON, W. D., 22, Bruce-road, Bow, E.
- Sept. 25, 1880. HUTCHISON, W. E., 9, Hill-street, Clapton, E.
- Dec. 18, 1880. JERVOISE, Sir J. CLARKE, Bart., Idsworth Park, Horndean, Hants.
- May 29, 1880. JESSE, FRANK.
- * JOHNSTON, ANDREW, *High Sheriff of Essex (Verderer of Epping Forest)*, The Firs, Woodford.
- Aug. 28, 1880. JONES, D. B., 13, Old Broad-street, E.C.
- Sept. 25, 1880. KELL, E. DELACOURT, Holland House, Spring Grove, near Isleworth.
- * KELLY, ALEXANDER, Sprigg's Oak, Epping.
- * KELLY (Mrs.), Sprigg's Oak, Epping.
- * KELLY (Miss), CATHERINE, Aubrey House, Woodford.
- * KING, DAVID A., St. Bartholomew's Hospital, E.C.
- * KING, JOSEPH E. S., 16, North-buildings, Finsbury-circus, E.C.
- * KING (Mrs.), 37, Arundel-square, Barnsbury, N.
- * KINGDON, Rev. H. J., M.A., Good Easter Vicarage, Chelmsford.
- Aug. 28, 1880. LEEMAN, Rev. ALFRED, M.A., &c., Starling Lodge, Buckhurst-hill.
- * LETCHFORD, R., F.R.M.S., &c., Prospect House, Woodford.
- * LINDSAY, R. B., 1, St. Ann's-terrace, Stamford-hill, N.
- * LISTER, ARTHUR, J.P., F.L.S., &c., Leytonstone.

Date of Election.

- * LOCKYER, ALFRED (*Hon. Librarian*), Tavistock-road, Snaresbrook.
- * LOCKYER, BERNARD, 33, Freegrove-road, Holloway, N.
- Nov. 27, 1880. LOCKYER, F. T., Raleigh, North Carolina, United States.
- * LOCKYER, G. H., Tavistock-road, Snaresbrook.
- * LUBBOCK, Sir JOHN, Bart., D.C.L., LL.D., M.P., F.R.S., F.G.S. (*President British Association*), High Elms, Farnborough, Kent.
- * MACKMURDO, WALTER GEORGE, Beechmont, Palmerston-road, Buckhurst-hill.
- July 24, 1880. MACKONCHIE, WILLIAM, St. Mary's Hospital, Paddington.
- * MAKINS, Colonel, M.P., J.P., D.L., &c., Prince's-gate, S.W.
- * MARRIAGE, F. G., Barnes Farm, near Chelmsford.
- Aug. 28, 1880. MARTIN, EDWARD, B.A., Barrister-at-law, F.Z.S., &c., 6, New-square, Lincoln's-inn, W.C.
- July 24, 1880. MARTIN, WALTER E., 1, Victoria-villas, Derby-road, Woodford.
- * MCKENZIE, ALEXANDER (Captain Hon. Artillery Company), *Superintendent of Epping Forest*, Ferrestone Lodge, Hornsey, N.
- * MCKENZIE, John A., Ferrestone Lodge, Hornsey, N.
- * MELDOLA, RAPHAEL, F.R.A.S., F.C.S., M.P.S., F.I.C., &c., *Vice-President of the Entomological Society (President)*, 21, John-street, Bedford-row, W.C.
- *† MELLES, WILLIAM, F.L.S., &c., Sewardstone Lodge, Sewardstone.

Date of Election.

- * MIALL (Miss), Darwen House, Buckhurst-hill.
- * MILDRED, Mrs., Chigwell.
- Dec. 18, 1880. MILLER, JAMES, Woodford Wells.
- Nov. 27, 1880. MORTEN, THOMAS S., 42, Haverstock-hill, N.W.
- * OLDHAM, CHARLES, 2, Warwick-villas, Chelmsford-road, Woodford.
- Aug. 28, 1880. ORMEROD (Miss), ELEANOR A., F.M.S., M.E.S., &c., Dunster Lodge, Spring-grove, Isleworth.
- * OWEN, JOHN, 320, Old-street, E.C.
- * OXLEY, FREDERICK, F.R.M.S., &c., Woodford, and 8, Crosby-square, E.C.
- Nov. 27, 1880. PARKER, CHARLES J., Rosslyn Villa, Snarebrook.
- * PARKER, JAMES F., 6, Adelaide-terrace, Ilford.
- Nov. 27, 1880. PELLE, Rev. THOMAS W., Rectory, Buckhurst-hill.
- * POWELL, NATHANIEL, J.P., D.L., &c., Buckhurst-hill.
- Aug. 28, 1880. PRIEST, ARTHUR, M.D., &c., Waltham Abbey.
- July 24, 1880. PRINCE, CHARLES E., M.R.C.S., &c., Buckhurst-hill.
- *† RAMSDEN, HILDEBRAND, M.A., F.L.S., F.R.M.S., &c. (*President of the Hackney Microscopical Society*), 26, Upper Bedford-place, Russell-square, W.C.
- * RAYLEIGH, The Right Hon. Lord, M.A., F.R.S., &c. (*Professor of Experimental Physics, University of Cambridge*), Terling-place, Witham, and 5, Salisbury-villas, Cambridge.

Date of Election.

- Aug.* 28, 1880. † REAY, The Right Hon. Lord, D.C.L., F.R.G.S., &c. (*President Social Science Congress*), 6, Great Stanhope-street, Mayfair, W.
- July* 24, 1880. REEVES, LUTHER, Prospect Cottage, George-lane, Woodford.
- Nov.* 27, 1880. RICHARDSON, EDWIN, 289A, King's-road, Chelsea, S.W.
- * RIDGEWAY, Rev. C. J., B.A., 31, Albany-street, Edinburgh.
- * ROBERTS, N. F., F.G.S., &c. (*Vice-President*), Rosebrae, Glengall-road, Woodford.
- * ROBERTS, SYDNEY, Stamford-hill, N.
- * RODWELL, Rev. R. M., M.A., &c., Rectory, High Laver.
- Aug.* 28, 1880. ROSSLYN, The Right Hon. the Earl of, M.A., F.Z.S., &c., Easton Lodge, Dunmow.
- * RUSSELL, Rev. A. F., M.A., Rectory, Chingford.
- Jan.* 22, 1881. RUSSELL, Lieut-Col., J.P., D.L., &c., Stubbers, Romford.
- * SAUL, DAVID H., 1, Elm-terrace, Woodford.
- Nov.* 27, 1880. SAUL, GEORGE T., F.Z.S., &c., Bow Lodge, 33, Bow-road, E.
- * SAWARD, WILLIAM, Epping.
- * SHIPLEY, ARTHUR E., Springfield, Windsor, Berks.
- May* 29, 1880. SMITH (Mrs.), Mary, Woolpits, Great Saling.
- Jan.* 22, 1881. SMITH, SAMUEL, 331, Hackney-road, N.E.
- * SMITH, SIDNEY, Tavistock Villa, Lea-bridge-road, Leyton.
- * SMITH, W. G. S. (*Hon. Sec. "Forest Fund"*), Rose Cottage, Forest Gate.
- * SMITHER, WILLIAM, Woodford Wells.
- * SMOOTHY, CHARLES, Bexfields Farm, Gal-leywood, Chelmsford.

Date of Election.

- * SNELL, EDWARD A., M.B., &c., 70, City-road, E.C.
- * SPICER, ALBERT, Woodford.
- Nov. 27, 1880. SPICER (Miss), ELLEN, "Harts," Woodford.
- * SPICER, GEORGE, "Harts," Woodford.
- * SPILLER, JOHN, F.C.S., &c., 2, St. Mary's-road, Canonbury, N.
- * SPILLER, WILLIAM, F.C.S., &c., Fitzjohn's-avenue, Hampstead, N.W.
- * STABLE, ROBERT S., Cleveland-road, Wanstead.
- * STANTON, H. T., F.R.S., F.L.S., F.G.S., (*President of the Entomological Society*), &c., Mountsfield, Lewisham, S.E.
- * STEPHENS, R. DARVELL S., Bradpole, Bridport, Dorset.
- * STEVENS, WILLIAM, The Green, Woodford.
- Jan: 22, 1881. STEWART, FREDERICK (*Hon. Sec. to the New Cross Microscopical Society*), 516, Kingsland-road, N.E.
- * SWALLOW, Rev. R. D., M.A., &c., Grammar School, Chigwell.
- * SWORDER, CHARLES B., Woodlands, Epping.
- * SWORDER, WALTER, 1, Blandford-villas, Queen's-road, Buckhurst-hill.
- * TAYLOR, THOMAS P., Bocking, Braintree, and St. Bartholomew's Hospital, E.C.
- May 29, 1880. † THOMAS, CHARLES, F.G.S., Clarendon House, Buckhurst-hill.
- Jan. 22, 1881. THOMASIN, JAMES G., St. Ann's, Hendon, Middlesex.
- „ „ THOMASIN (Mrs.), J. G., St. Ann's, Hendon, Middlesex.
- * THOMPSON, A., Beech View, Buckhurst-hill,

Date of Election.

- June* 26, 1880. THOMPSON, ERNEST E., 66, Albany-street,
Regent's-park, W.
- July* 24, 1880. THOMPSON, ROBERT M. BIRD, Walden Hall,
Saffron Walden.
- Nov.* 27, 1880. THORP, WILLIAM, B.Sc., F.C.S., F.I.C.,
39, Sandringham-road, Kingsland, E.
* THORPE (Mrs.), Dowgate, Cambridge-park,
Wanstead.
* TOZER, EDWARD, Woodford.
- June* 26, 1880. TRAVIS, J., Saffron Walden.
* TRIMMER, FRANCIS, M.D., &c., Forest Gate.
- Aug.* 28, 1880. TURNER, W. PICKETT, M.R.C.S., &c., Lan-
caster-terrace, Leytonstone.
* TWEED, WALTER, Epping.
* UNWIN, T. FISHER, The Elms, Woodford
Bridge, Chigwell.
- Nov.* 27, 1880. VARLEY, FREDERICK H., F.R.A.S., M.P.S.,
&c., Mildmay Park Works, Mildmay-
avenue, Highbury, N.
* VAUGHAN, HOWARD, M.E.S., 11, Ospringe-
road, Brecknock-road, N.W.
* VINCENT, RALPH, Leytonstone.
* WAKEFIELD, W. T., Farm-hill, Waltham
Abbey.
- June* 26, 1880. WALKER, Rev. F. A., B.D., F.L.S., &c.,
Bourne Villa, Bournemouth, Hants.
- June* 26, 1880. WALLER, JOHN, 5, Talbot-road, Totten-
ham, N.
- Aug.* 28, 1880. †WALSINGHAM, Lord, M.A., F.Z.S., M.E.S.,
&c., Eaton House, Eaton-square, S.W.
- May* 29, 1880. WELSH, CHARLES, 6, Julia-terrace, Leyton-
stone.
- Nov.* 27, 1880. WELLS, FRANK B., 25, Lorne-road, Finsbury
Park, N.
* WESTON, WALTER P., Auburn Villa, Disraeli-
road, Putney, S.W.
- Nov.* 27, 1880. WHEELER, E., Whitehall-road, Woodford.

Date of Election.

- * WHITBOURN (Miss), Darwen House, Buckhurst-hill.
 - * WHITE, WILLIAM, Morden House, 55, Highbury-hill, N.
 - * WILSON, REV. W. LINTON, M.A. (*Vice-President*), Oakhurst, Chigwell.
 - *† WINSTONE, BENJAMIN, M.R.C.S., &c., Ockridge, Epping; *and* 53, Russell-square, W.C.
- June* 26, 1880. WRIGHT, W. H., Oakburn, New-road, Buckhurst-hill.
- Jan.* 22, 1880. WRIGHT, REV. W. J., B.A., St. John's, Stratford.
- * YEATES (Mrs.), Erin Villa, Buckhurst-hill.
 - * YOUNG, FREDERICK, J.P., &c. (*President "Forest Fund"*), 5, Queensberry-place, Queen's Gate, S.W.

*N.B.—Members are requested to give early notice of any
Change of Address to the Hon. Secretary.*

AN
INAUGURAL ADDRESS

DELIVERED TO

THE EPPING FOREST

AND

COUNTY OF ESSEX NATURALISTS'
FIELD CLUB,

FEBRUARY 28th, 1880.

BY

RAPHAEL MELDOLA, F.R.A.S., F.C.S.,

Sec. Ent. Soc., &c., President.

"Tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."

PUBLISHED BY THE CLUB, BUCKHURST HILL.
1880.



THE
PRESIDENT'S INAUGURAL ADDRESS.

Delivered February 28th, 1880.

LADIES AND GENTLEMEN,

Before proceeding to consider the objects and functions of the "Epping Forest and County of Essex Naturalist's Field Club," it is my pleasing duty to return thanks for the honour which you have conferred upon me in electing me as your first President. In taking upon myself the honourable duties of this position, which I shall endeavour to discharge to the best of my ability, I cannot but regret that this chair is not occupied by some gentleman having more claim than myself to be considered as a naturalist. Although long devoted to this study, the pressure of work of more immediate necessity has left me without the time necessary to follow up the subject with that persistency so necessary for the achievement of useful results in any branch of science. I accept the position with the more pleasure, however, as having been a former inhabitant of the Forest District, and a constant frequenter of the Forest itself, in whose glades my own early tastes for field natural history first found full scope for gratification.

As already stated in our preliminary circulars, considering the proximity of Epping Forest to London, and the fine field which it offers to the naturalist, it is a matter of surprise that no such Society as that which we may now congratulate ourselves upon having called into existence has hitherto been formed. The idea of establishing such a Club has long been present, although but vaguely, in the minds of many *habitues* of the Forest and surrounding country, but no defined scheme was broached till our energetic Honorary Secretary, Mr.

William Cole, took the subject up, and by his zeal and energy gave to this

“ Airy nothing

A local habitation and a name.”

Our Society, in general terms, may be said to have for its scope the study of nature in the field. So many eminent writers have already treated of the advantages to be derived from the study of nature at first hand, instead of from books and museums, that any remarks which I might have to offer on this subject could not but be the echoes of opinions already expressed. In the words of Goethe we may exclaim:—“ Nature! we are surrounded and embraced by her: powerless to separate ourselves from her, and powerless to penetrate beyond her. She is ever shaping new forms: what is has never yet been; what has been comes not again. Everything is new, and yet nought but the old. We live in her midst and know her not. She is incessantly speaking to us. ”

That the Epping Forest and County Field Club has met a public want let the facts now speak for themselves. Although not quite two months old, we already number more than 140 original members. Our cause has been warmly taken up by the press; in its first attempts to struggle into existence the infant Society has met with kindly encouragement on all sides, and many of the foremost naturalists of this country have signified their approval of our objects. It is unnecessary for us, therefore, to plead any excuse for our *raison d'être*—it only remains for us to show those who have so readily extended the hand of encouragement, by our future work, that their sympathy has not been given in vain. We now look forward—I may add with confidence—to receiving from our members substantial support in the way of contributions to our publications, exhibitions of specimens at our meetings, and the discussion of problems in natural science in that amicable spirit which is most conducive to the real advancement of knowledge.

In forming a Society such as the present Field Club our primary object is of course the furthering of science—the annual addition of something, however humble, to the general

stock of human knowledge. In Epping Forest and the County of Essex we have a fine area to work in, and I am happy to say that we already include in our ranks many members well versed in special branches of natural history (using this term in its widest sense) to whom we shall look for assistance in their respective subjects; and I am also glad to be able to announce that many eminent specialists outside our own Society have promised their valuable aid in identifying specimens or in other ways promoting the objects of the Club. Our chief object, the advancement of natural science, will be best effected by the publication of *original papers*, notes, and discussions. But we must likewise bear in mind that science will be also indirectly promoted by mutual intercourse and instruction, and, above all, by fostering and educating the scientific faculty in our younger members. Who knows but that in the County of Essex there may be another John Ray or some future Darwin waiting only for encouragement and the spirit of emulation to develop faculties which will subsequently establish him in a high position in the world of science. The discovery of such an individual would surely be of far greater importance to science than the discovery of a species new to the British fauna or flora. It is our duty to go forth into the highways and byeways and bring such members into our fold. The sociable gatherings of a Field Club are far more calculated to inspire the young scientific aspirant with confidence in his own powers than the more formal meetings of a learned Society, where stern discussion is necessary, and where valuable metal must be separated from useless dross by a process of rigid criticism. Nor can our older members, whether naturalists or not, fail to derive benefit from association with those who have studied for themselves some page in the great book of nature. In these days when science is progressing with such gigantic strides that no one man can keep pace with its development in all branches—when specialism has become an absolute necessity for individual advancement, and when results of value can only be obtained by rigidly limiting oneself to some restricted subject, and ignoring, for the time, the rest of nature—there is much to be learnt by interchanging ideas with those who

are occupied with subjects distinct from one's own. It has often been said that to be thoroughly educated we should "know something of everything and everything of something;" the specialist, however, being obliged to ignore the existence of nature outside his own subject, is too apt to think that beyond his own province there is nothing worth investigating—he has been travelling for a great many years down a lane between dead walls in which it is sometimes necessary to make a breach in order to show him that there is open country beyond. If the friendly gatherings of our Club are in any way conducive to enlarging the ideas, on the one hand, of those who have never yet directly asked a question of nature, and, on the other, of those who have spent years in prying laboriously into some obscure corner of her domain, one of our main objects will have been accomplished.

Thus, in addition to the acquisition of new knowledge, Field Clubs are capable of doing good work in the way of education. The faculty of paramount importance to the scientist is that of *observation*, and no study is better calculated to develop this faculty than that of natural history. The power of observation comes naturally to the young, but unfortunately is too often extinguished before maturity is reached by the ignorance of those whose solemn duty it should have been to have assisted the development of this instinct. Charles Dickens says ("David Copperfield," Chap. II.):—"I believe the powers of observation in numbers of very young children to be quite wonderful for its closeness and accuracy. Indeed, I think that most grown men who are remarkable in this respect may with greater propriety be said not to have lost the faculty, than to have acquired it; the rather, as I generally observe such men to retain a certain freshness and gentleness, and capacity of being pleased, which are also an inheritance they have preserved from their childhood." Comparing our young Society with a growing child, let us foster among our members this observational faculty, and let us hope that we shall reach a vigorous intellectual manhood, and in due time become a "feeder" of the learned societies.

Our most useful work will thus be at first the observation and recording of the phenomena of that district which we

have fixed upon as the field for our studies. With this alone we have a large and pleasant task in hand. The County of Essex, and especially Epping Forest, has already been worked by many highly competent observers, but nature's stores are inexhaustible—there are no blind alleys in science, and what has been already recorded must serve as the point of departure for our future work. The observations of our predecessors, moreover, are to a great extent scattered throughout various publications, and are therefore without that *local* significance to which a true scientific meaning may one day be attached. We must make it a part of our duties to centralize these observations, and in time we may aspire to the proud position of seeing our publications regarded as the authority in all that relates to the natural history of the county.

With regard to the special nature of the observations with which we may commence our labours, no definite programme can be laid down at starting. This must be entirely left to the taste and knowledge of our members, and I can here only offer a few general suggestions. Some remarks recently made to the Dulwich College Science Society by my friend and colleague Mr. W. L. Distant are equally applicable to our own Club:—"The object of the Society is to promote and increase the knowledge of the natural history of the neighbourhood, and the first step, but the most indispensable one towards it, is to aim at having a complete catalogue of its flora and fauna. In other words, before we can study the inhabitants with any amount of completeness we must possess their names and addresses. The Society should thus be a Biological Registry Office. But this is not all. In certain communities which are still in an arrested or undeveloped condition of culture there exists a system of espionage or secret police, the aim of which is to know as much about everybody as possible, from purely unscientific motives. I would advocate in the strictest scientific sense that you establish a bureaucracy in this neighbourhood in which man only shall escape your domiciliary visits, by which a rabbit shall not leave his burrow without in some way you have an explanation of his goings out and of his comings in; that every bird shall be 'suspect' who, sojourning here for a period only of

the year, mysteriously disappears for the remainder ; and that the strictest police supervision should entail on all insects whose purposes or habits are unknown."

When we look at the numerous woodland patches scattered throughout the County of Essex, we can entertain no doubt but that our district was originally covered with forest. It is recorded that in the reign of Henry III. a royal forest extended right across the county in a north-easterly direction from Stratford Bridge to Manningtree. In the reign of Charles I. the great Waltham Forest comprised Epping and the now almost extinct Hainhault Forests, thus forming a large woodland area bounded to the east by the River Roding, to the west by the River Lea, to the south by the great Chelmsford and Colchester road, and stretching northwards for sixteen miles as far as Roydon, almost on the boundary of the county. Thus, as might have been anticipated, our district is especially rich in woodland species. Epping Forest itself, so far as my own experience goes, certainly does not appear to be so productive from a collecting point of view as some of the woods of Kent and Surrey to the South of London ; but our county, taken as a whole, has furnished many rarities. We shall hope in the course of time to be in a position to furnish local catalogues of animals and plants, for the preparation of which we shall look to our ornithologists, botanists, entomologists, microscopists, &c. I do not propose on the present occasion to enter into much detail respecting the natural productions of our district, as I should thus only have to tax your patience with a long list of specific names ; but I will restrict myself to a few general remarks.

Mr. Edward Newman has given the names of seven species of bats* as being found in the Forest ; and with regard to birds, Mr. James English, one of our members, whose name as a collector was long associated with that of the late Henry Doubleday of Epping, has recorded about 120 species,* 20 of which are occasional visitors driven into the Forest by stress of weather or other causes. The total number of birds consi-

* See Appendix.

dered by the best authorities to be truly British is about 350 species, so that in Epping Forest alone this interesting class is fairly represented; and if we included the species found in other parts of the county, and particularly on the coast, the list would doubtless be considerably increased. I may likewise state that three specimens of the Great Bustard have recently been shot in the county. The list of insects of Epping Forest and other parts of the county includes many rare species. Thus in the way of beetles, Mr. T. R. Billups, one of our members, has lately succeeded in capturing at West Ham a species which had not been met with for nearly seventy years—viz., *Spercheus emarginatus*; and in the same locality numerous other rare and local species, such as *Xantholinus fulgidus*, *Philonthus thermarum*, *Stenus fornicatus*, *Quedius puncticollis*, the new *Helophorus aequalis*, &c. At Loughton this same collector has taken the very scarce *Euplectus ambiguus*. Of the sixty-seven species of butterflies found in Britain, forty-six are mentioned by Newman as occurring in Essex, and three or four more species may possibly be added if search is made for them in those parts of the county that are on the chalk. From a list of the larger moths drawn up for me by Mr. Cole, it appears also that the collector may be rewarded by many prizes, whilst among the smaller species of *Deltoides*, *Pyrallites*, *Crambites*, *Tortrices*, and *Tineina*, I am persuaded that there is yet a very rich harvest to be gathered in the Forest and elsewhere in the county. To the lepidopterist, indeed, our district has already been made famous by the capture of such species as *Erastria venustula* by the late Henry Doubleday, and *Sophronia emortualis* by Mr. Charles Healy. Epping Forest has furnished also the rare *Gluphisia crenata*, the almost unique *Eupithecia egenaria* and *Stigmonota leguminana*, whilst Mr. Cole last autumn succeeded in adding a very pretty geometer, *Sterrrha saccharia*, to the list of Essex Lepidoptera. Then again we have *Geometra smaragdaria*—the “Essex Emerald”—a rare moth well known to be a speciality of our county, found in the low marshes about Southend, St. Osyth, &c.; and also the extremely local *Aleucis pictaria* found about Loughton. With respect to Hymenoptera, I am informed by Mr. E. A. Fitch, who is an authority on the subject of galls,

that of his list of forty-one cynipideous oak-galls known as British, he has found all but six in Essex. In 1868 only fourteen species were known as British, so that twenty-seven species have been added in twelve years—a fact which surely offers encouragement to our workers to pursue further investigations in this direction. The absence of sandy banks will account for our poverty in fossorial Hymenoptera. Of other orders of insects, Mr. Doubleday has published a list of thirty species of dragon-flies (*Odonata*) as being known to occur in our Forest, this number being about two-thirds of the British species.

To the botanist our district offers a fine field—Epping Forest is indeed regarded as being among the richest localities for plants in the vicinity of London; but I should be overstepping the bounds of all reasonable time did I attempt to specify any of the rare flowering plants, ferns, fungi, mosses, and lichens that nature has so lavishly spread through the county. At present the standard work of reference for our botanist is Gibson's "Flora of Essex," published in 1862, and there is an older and now extremely rare book by Richard Warner entitled "*Plantæ Woodfordiensis*," published so far back as 1771.*

The outdoor study of the natural history of the county will of course be conducted as heretofore by our members independently, each according to his particular subject, but the formation of this Club will, I venture to think, add greatly to the zest of their pursuits. The pleasure of adding some new or rare species to the Essex fauna or flora, or of making some new and interesting observation, will assuredly be greatly enhanced by knowing that at the next meeting of the Club the captor or observer will have an opportunity of making known his results to those of kindred tastes, and an additional impulse will thus be given to his work. Such observations as our members may bring forward, or such specimens as may be exhibited at our meetings, will be gladly welcomed by the Council, and will be recorded in our publications.

To many, and especially to our younger members, the new Club may perhaps be a means of inducement for taking up the

* See Appendix.

study of some branch of natural history for the first time. Every one of our members who may possess any special knowledge will, I am sure, gladly lay open the stores of his information for the assistance of such beginners. Were I asked how such studies ought to be commenced, I would unhesitatingly say—begin by making a collection. Fix upon some group of animals or plants that may specially appeal to your interest, and get together as many species as you can, collecting them in all cases where possible with your own hand, and noting their habits and localities in so doing. You will thus get together a certain amount of raw materials which will require further study in order to arrange them; you are in the position of a child with a dissected puzzle, and the problem before you is to arrange your collection *naturally*—i.e., to bring together those forms that are akin and to separate those which are not allied. In this way by referring to standard works, or still better to living authorities, the great principle of biological classification will gradually dawn upon you, the organic forms by which you are surrounded will become imbued with a new interest, you will be born again into the kingdom of nature, and the lowliest plant or the most minute insect that you had formerly passed unheeded by will no longer be in your eyes as unmeaning fragments, but will become portions of a great system—parts of that

“Stupendous whole,
Whose body Nature is, and God the soul.”

In order to grasp this principle of classification thoroughly and scientifically, it is not sufficient to know that this or that book catalogues the species in such or such order. You must ask in every particular case *why* these species have been grouped together and those separated from them. The system of making a collection first and then arranging it from some already classified cabinet is, I am persuaded, a most pernicious one so far as the educational value of collecting natural history specimens is concerned. It is those who have accumulated row upon row of insects without any ultimate object in view beyond the mere possession of specimens who have made of “the mere collector” a “nayword and a common

recreation," and the gulf which separates such collectors from the much-despised maker of ornamental wall-cases is not a very wide one. I would emphatically urge upon those about to take up the scientific study of natural history from the very necessary beginning of making and arranging a collection—eradicate from your disposition the desire of possessing "fine series;" let the *cacoethes carpendi* once take possession of you and your career as a scientific biologist is doomed. We shall hope that the taste for collecting which may be engendered in the county by the foundation of this Field Club will, as enforced in our rules, be exercised *judiciously and moderately*. In the case of insects, excepting of course in species of great variability, some three or four, or at most half-a-dozen, specimens are amply sufficient for all purposes of study. There are many who have assisted in the wholesale extermination of some species almost extinct for the mere gratification of possessing a "finer series" than their neighbours; such collectors are guilty of nothing less than a biological crime as heinous in the eyes of the naturalist as would be the destruction of some "ancient monument" in the opinion of the archæologist.

In the course of time and as our Society continues to flourish—as it surely will if it only fulfils the promises of its early youth—we shall hope to establish permanent collections in a museum, and any specimens which our members may like to contribute for furnishing the nucleus of such a public collection will at any time be thankfully received. During the first years of our existence, when our funds will be necessarily limited, we shall of course be unable without external aid to establish anything in the way of a Natural History Museum that would be at all worthy of the County Club—the growth of such an institution will be a work of time; but in order to accelerate matters I would suggest that a "Museum Fund" be started among our members, and that our Treasurer should keep a separate account of such donations, which would be allowed to accumulate, and from time to time increased by such sums from our general income as the Council might think proper to devote to this object, until a sufficient amount is obtained to warrant our fixing upon some place for our permanent head-quarters.

Apart from the obvious advantages of having in one building our collections, library, and meeting-room, and of leading an independent instead of a parasitical existence, the formation of a permanent museum would, I am convinced, promote our objects in many other ways. Our "Biological Registry Office" would become better known throughout the county, and useful specimens which by accident might fall into the hands of the non-scientific would naturally be sent to our museum. Then the large number of species which would have at first to be collected would lead our active workers to co-operate for a common object—the formation of a *typical collection* representing the natural history of the county. In this undertaking our would-be beginners might well take a part, and in so doing would commence to derive those educational advantages arising from the study of field zoology and botany to which I have already referred.

It will be far more satisfactory to have a general collection formed in all parts of the county by our own members for the express purpose of being deposited in our cabinets than to exhibit the "tag, rag, and bobtail" of old collections, or to expose to public view the faded and dilapidated specimens to be seen in many local museums, both at home and abroad, the authorities of which should regard their tattered possessions with much the same feelings as did Sir John Falstaff his ragged regiment. In addition to collections of species illustrating the actual productions of our district, it would be most especially desirable in the case of insects to have preparations showing the life-history at every stage of transformation, and dissected specimens illustrating the structure and anatomy. In time we might thus come to possess a collection both of educational and technical value that would not be unworthy of a Field Club which already includes members of many of the most influential families in the county, and which might ultimately become of scientific use to specialists outside our own ranks—"a consummation devoutly to be wished."

The geological features of the County of Essex have been

mapped out broadly by the Geological Survey,* but there is yet much work to be done in the way of filling in details, especially with regard to the Drift and other superficial deposits. Geologically considered, our district is comparatively modern, the oldest formation being the chalk which crops out on the Essex shore of the Thames about Purfleet, and extends to just beyond Little Thurrock, a distance of some five miles in an easterly direction. Overlying this strip of chalk at its eastern extremity there is a detached patch of Thanet sand. A line drawn across from Grays Thurrock to Stifford, the northern limit of the chalk at about its widest part, would be nearly one mile and three-quarters in length. At Bishop Stortford the chalk again appears. The thickness of this formation in the London Basin is from over 600 to more than 1,000 feet; a boring carried down into the Gault at Loughton Station gave a thickness of about 690 feet, and at Harwich a boring to a depth of 1,042 feet carried down into strata below the Gault showed the chalk to be 888 feet thick. Cretaceous fossils have been obtained in some abundance from the chalk pits at Grays and Purfleet. By far the larger portion of our county stands on the tertiary formations above the chalk. Of the Lower Eocene series the Thanet Sands are present in a broken band of about one mile in width at its widest part, and of an average thickness of about thirty feet, which crops out to the north of Purfleet, and following the chalk extends eastward along the valley of the Thames. The chalk pits at Purfleet and Grays show well the junction of the two formations. Next in order above the Thanet beds we have the Woolwich and Reading beds following the former, as a narrow strip commencing about Wennington and extending eastwards to Stifford, where the strip commences to broaden out, and another patch of the same beds is found about Stratford and West Ham, to the east of the alluvium of the Lea valley. The Woolwich and Reading beds have an average thickness of about fifty feet. The uppermost member of the Lower Eocene

* In making the following rough sketch of the geology of the county I have largely availed myself of the admirable publications of Mr. W. Whitaker, of H.M. Geological Survey, as well as of the maps published by the Survey.

formation, the London Clay, although to a great extent covered by Drift deposits, forms by far the larger portion of the beds on which our district stands. The hills in many parts of Essex—such for instance as the ridge extending from Chingford to Waltham Abbey and the range about Havering-atte-Bower and Brentwood—are entirely of London Clay, in many cases capped with outliers of Bagshot sand and Drift formations. We have but to call to mind High Beech in our own neighbourhood to see that the most picturesque features of the county are due to this formation. Sections of the London Clay, which is about 420 feet thick in the neighbourhood of the metropolis, have been exposed in Essex at Buckhurst Hill, Theydon, Brentwood, Stifford, Upminster, Warley, &c., and sections of this formation showing its junction with the Woolwich and Reading beds have been exposed at Bishop Stortford and Roydon. The Middle Eocene period is represented in our county by the Bagshot Sands already alluded to, which form outliers capping many of our hills, such as at High Beech, Crabtree Hill near Lambourn, South Weald, Havering, Blackmore, and large patches stretching northwards from Warley Common to beyond Brentwood and again about Kelvedon Hatch. One other very interesting formation of Pliocene date—the Crag—just commences to appear in the north-eastern corner of the county at Manningtree, south of the Stour valley, and Walton-on-the-Naze has furnished Red Crag fossils of special geological interest.

At about that period of the earth's history when the Crag formations were deposited, our globe, owing to a certain combination of astronomical events, began to experience those great climatic changes which resulted in the Glacial Period, during which the whole of the northern portions of Europe and America were laid under an icy covering of great glaciers which flowed down from all the mountain slopes and high lands, levelling up the valleys, and becoming confluent, formed a gigantic ice-sheet, which extended southwards into regions which now enjoy a temperate climate, whilst floating icebergs and rafts drifted even into tropical seas, and there thawing, scattered their accumulated burdens of rock fragments and miscellaneous *débris* over the sea bottom. The Glacial Epoch,

which began about 240,000 years ago and lasted for some 160,000 years, does not appear to have been one uninterrupted era of intense arctic climate, but several milder periods intervened, when the great ice-sheet retreated northwards and the glaciers remained confined to the mountain-tops, till the recurrence of the glacial climate again caused them to spread to the lowlands and once more to push their way southwards. During those mild inter-glacial periods, when the arctic forms that inhabited this country had retreated with the glaciers, animals such as the mammoth, rhinoceros, hippopotamus, lion, tiger, bear, hyæna, &c., became inhabitants of Britain, which was then connected with the continent of Europe across what is now the German Ocean. The old inter-glacial mammals—and probably Palæolithic man was among them—would have told of mighty revolutions in physical geography could they have kept records, as our island, after they had taken possession of it, became submerged beneath the sea to an immense depth, till only the high lands appeared above the waters, forming an archipelago. Then followed a final return of glacial conditions, when the great ice-covering for the last time enwrapped our country, which slowly rose from the frozen ocean and once again became a portion of the continent. As the more genial climate which has lasted to our own times came on, the ice-sheet slowly disappeared; glaciers lingered for some time on our mountains, and finally vanished, to return no more till the next glacial epoch. It was during these continental states of Britain, when the Thames was a tributary of the Rhine, that the country became the home of those animals and plants the survivors of which constitute our present fauna and flora, the sea finally sweeping away the land connection and leaving our island much as we now find it.

The records of "the great ice age" are more forcibly impressed upon the mountainous districts of Wales, Scotland, and the Lake District than in the southern portions of England. The great submergence which preceded the last glacial relapse left only the south of our island above the sea, and a line drawn across the country from the mouth of the Thames to the mouth of the Severn represents the southernmost

boundary of glacial action in this country. Those superficial deposits which I have formerly alluded to as Drift are mostly of glacial origin, and sections have been exposed in the immediate neighbourhood of London, as at Muswell Hill and Finchley, and also on the hills of our county at Theydon Mount, Buckhurst Hill, Epping, Stondon Massey, Hutton, &c.

I have thought it necessary to lay before you this brief sketch of the existing knowledge respecting the Glacial Period because the latter forms an epoch in the life of the earth from which must be dated the present aspect of our country and of its living forms, and further, because a large field for labour here lies before our geological members in attempting to determine the relative ages of the various Drift deposits of our own district, and thus contributing our mite towards erecting the structure of that noble science which regards "ages as its days."

Although leading authorities are now agreed that man existed prior to the Glacial Epoch, the most convincing proofs that we have of his existence are of inter-glacial and post-glacial age. The savage predecessors of the various peoples that have been known to successively inhabit our country during the historical period—prehistoric man, who roamed through Britain and dwelt in our caves when the mammoth, the hippopotamus, the rhinoceros, the reindeer, and other animals here extinct formed a portion of our fauna, has left his traces in the rude flint implements of our ancient river gravels. Our county is situated in that portion of England which has been most prolific in yielding implements of early human workmanship belonging to the old stone or Palæolithic age, and we are fortunate in having on our southern boundary the broad alluvium of the Thames, with that of its tributary streams, such as the Lea and the Roding. The Thames alluvium stretches, according to Mr. Prestwich, from above Maidenhead to the sea, varying in width from two to nine miles, and in thickness from five to fifteen feet. Flint implements have been found at many places along the Thames Valley, and quite recently Mr. Worthington Smith has discovered such implements in the valley of the Lea. This gentleman writes to me :—"Up to the present time I have

found thirty-one Palæolithic implements in the gravels on both sides of the Lea between Clapton and Leyton or Forest Gate. These implements are mostly pointed or lanceolate, a few ovate. I have also found seven 'trimmed flakes,' as they are termed—*i.e.*, flints chipped all over one side (like an implement), the other side being plain or nearly so. Add to this several hundreds of flakes of all sorts and sizes—a few bones and fragments of mammoths' tusks, &c." Among numerous microscopic objects found in the gravel of the Lea Valley, at a depth of twelve feet, Mr. Smith has also discovered some human hair, which he believes to be of Palæolithic age. The remains of animals of post-glacial age have been discovered plentifully in the chalk quarries and brick-earth pits at Gray's Thurrock and Ilford*—these districts indeed appear to be veritable geological Tom Tiddler's grounds—and sections of Post-glacial beds have likewise been exposed at Leyton, Aveley, Plaistow, and in the Roding Valley at Theydon Bois. Among more recent deposits we have an old sunken forest in the peat opposite Walthamstow Marshes, which extends for several miles, and is exposed at low water.

Palæolithic man was followed by his Neolithic successors, who peopled this country after the last great glacial submergence; then we have evidence of those advances in civilization which resulted in the use of bronze, and finally in the iron age. The great geological record here passes into the historical period, the study of which comes into the province of archæology. On this subject I shall have very little to say. Good work has been done, and will no doubt continue to be done, by the Essex Archæological Society, and the fine collection of antiquities in the Colchester Museum is partly the result of their labours. The ancient earthworks recently discovered in Epping Forest by Mr. B. H. Cowper, and surveyed by Mr. William D'Oyley, will be of special archæological interest to us. The Loughton Camp is supposed to

* Among the mammalian remains found in these pits are the mammoth, two species of elephants, hippopotamus, rhinoceros, hyæna, bison, two species of bears, Irish elk, cave lion, wolf, &c. Sir Antonio Brady's Museum, at Stratford-le-Point, contained a collection of Post-glacial fossils of world-wide celebrity, now presented to the British Museum.

have been the work of the Ancient Britons, and the Camp at Ambresbury Banks that of their Roman enemies.*

That surviving remnant of primitive forest, of some 4,900 acres, which we claim as the chief centre of our studies, is, by Act of Parliament, to remain for ever unenclosed and unbuilt upon; and, as a Society founded for promoting a knowledge of the natural history of the neighbourhood, we cannot but rejoice that such a state of affairs has been established—chiefly by the energetic action of the Corporation of London. But while, as naturalists, we rejoice at the large area thus unreservedly thrown open for our investigations, as men we must not forget to give our sympathy to those who have indirectly suffered by the culpable actions of the depredators.

As to the future of the Forest, we cannot do more than forcibly support the views unanimously expressed wherever the subject has been discussed—that it should be left alone as much as possible. By this means alone can it be preserved as a “Natural Forest.” The workings of nature are connected and bound up in such endless and unsuspected ways that any interference on the part of man may unknowingly upset the adjustments that have taken ages for their perfection; and in addition to any obvious results that may follow from some change made in primitive forest land there may ensue an endless chain of consequences to the animals and plants that were totally unlooked for. The opinions of naturalists have already been expressed on this point—foremost among whom Mr. A. R. Wallace† has pointed out the evils that would arise from indiscriminate and extensive draining. With regard to the large tract of land of nearly 1,000 acres which was formerly enclosed and in most part cultivated, but which is now thrown open and added to the Forest, we have a magnificent area for experimental natural

* See the pamphlet on this subject by Mr. B. H. Cowper, published by the Committee of the Epping Forest Fund.

† *Fortnightly Review*, Nov. 1st, 1878. See also the paper by Mr. Wm. Paul, and the discussion in the *Journal of the Society of Arts*, Jan. 30, 1880.

history, and we shall anxiously watch the proceedings of the Conservators with respect to this portion. For my own part, I cannot help expressing the opinion that Mr. Wallace's suggestion to make this tract into "several distinct portions of forest, each composed solely of trees and shrubs which are natives of one of the great forest regions of the temperate zone," appears to be most feasible and inexpensive.

The Epping Forest and County of Essex Naturalists' Field Club has been formed in a county already made famous in the annals of science by such names as those of the illustrious John Ray, son of a blacksmith, who was born in 1627 and died in 1705 at Black Notley, between Witham and Braintree; of Dr. Derham (1657—1735), rector of Upminster, whose "Physico-Theology" went through at least thirteen editions. Samuel Dale (1659—1739), an Essex Naturalist, wrote the "History of Harwich" (1730), and Richard Warner (1711—1775) was the author of the "*Plantæ Woodfordiensis*" to which I have already referred. In more recent times our county produced the celebrated Edward Doubleday, and *the* Epping Naturalist, his brother, Henry Doubleday, who was born in 1809 and died in 1875. Francis Walker, the entomologist, born also in 1809, died at his residence, Elm Hall, Wanstead, in 1874. Let us hope that to this list the future historian of science may have to add the names of some whose natural history studies were first instigated by the foundation of this Field Club.

When our Society shall have arrived at that happy mechanical condition known as a "moving equilibrium," I would suggest that those of our members who have kindred tastes should co-operate for the purpose of assisting natural history in fields where "many hands can make light work." Thus our entomologists might work together for two or three seasons and devote their entire attention to collecting some neglected order, such as the *Diptera*, *Hemiptera*, &c., and thus hasten the accumulation of materials necessary for the production of local catalogues, and the same might be done for other groups of animals or plants.

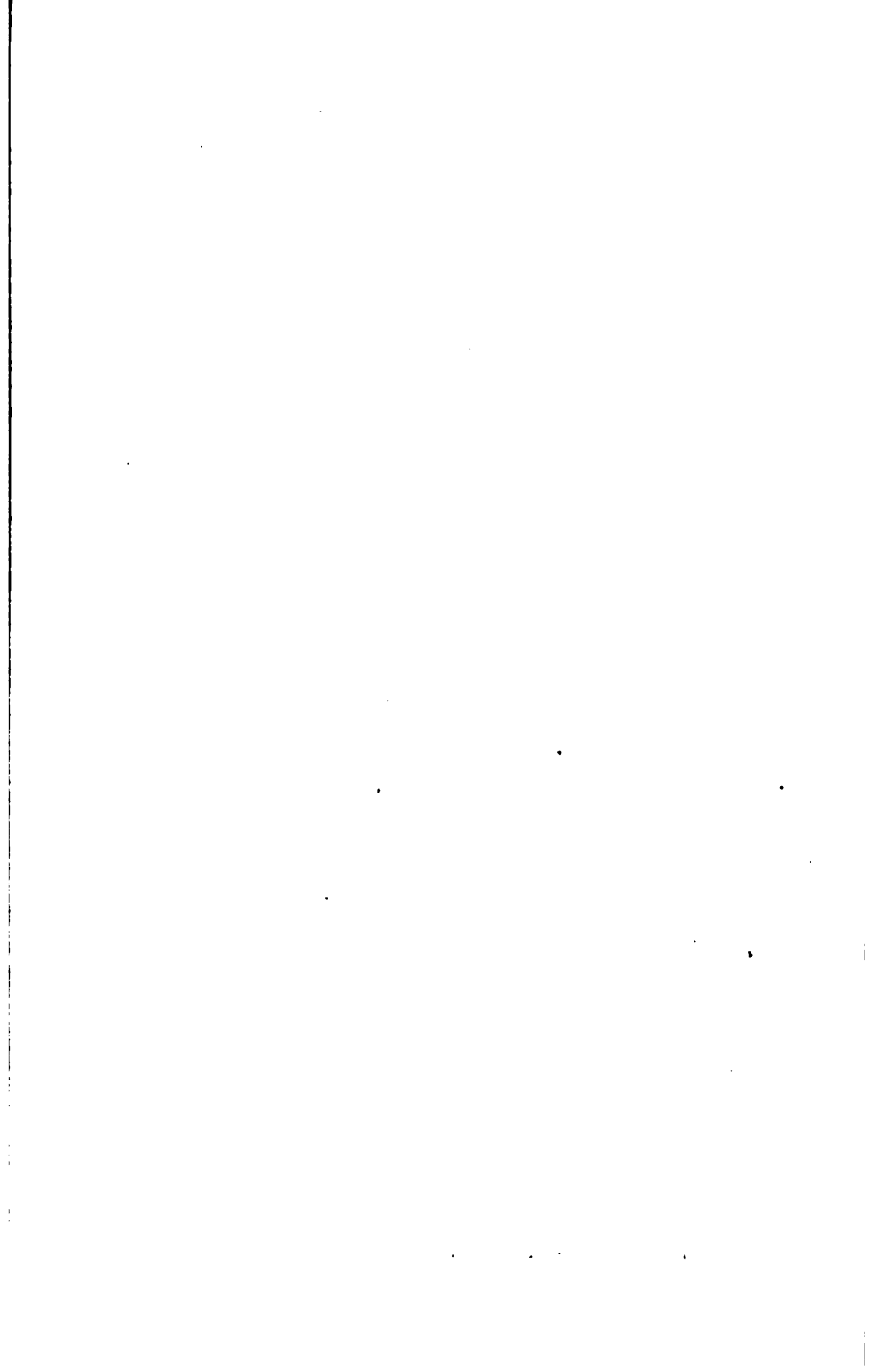
Our field meetings will, I trust, lead to many a social ramble, the pleasures of which will be greatly enhanced by

having some definite object in view. We must strive to get beyond that often-quoted Peter Bell to whom

" A primrose by the river's brim,
A yellow primrose was to him,
And it was nothing more "

—an unfortunate individual whom we as naturalists must regard as a type of the blissfully ignorant. In science ignorance is not bliss, and no advance will be made if we rest contented with "it was nothing more." Nature is one—her votaries are many—but how few are her prophets! There is no natural phenomenon, however apparently insignificant, which does not appeal to us—there is not a pebble on our hill tops that does not incessantly cry out to us with a hundred tongues to read and learn. Surely to the naturalist of all others is it given to find—

" Tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."



APPENDIX.

THE BATS OF EPPING FOREST.

(From Mr. Edward Newman's List.)

<i>Plecotus auritus.</i>	The Long-eared Bat.	<i>Vespertilio Daubentonii.</i>	Daubenton's Bat.
<i>Synotis barbastellus.</i>	The Barbastelle.	<i>Vespertilio mystacinus.</i>	The Whiskered Bat.
<i>Vesperugo pipistrellus.</i>	The Pipistrelle.		
<i>Vesperugo noctula.</i>	The Noctule.		
<i>Vespertilio Nattereri.</i>	Natterer's Bat.		

THE BIRDS OF EPPING FOREST.

(From Mr. James English's List.)

<i>Deulias luscinia.</i>	Nightingale.	<i>Locustella naevia.</i>	Grasshopper Warbler.
<i>Ruticilla phoenicurus.</i>	Redstart.	<i>Parus major.</i>	Great Titmouse.
<i>Erithacus rubecula.</i>	Redbreast.	<i>Parus caeruleus.</i>	Blue Titmouse.
<i>Pratincola rubicola.</i>	Stonechat.	<i>Parus ater.</i>	Cole Titmouse.
<i>Pratincola rubetra.</i>	Whinchat.	<i>Parus palustris.</i>	Marsh Titmouse.
<i>Saxicola oenanthe.</i>	Wheatear.	<i>Acredula caudata.</i>	Long-tailed Titmouse.
<i>Turdus viscivorus.</i>	Missel Thrush.	<i>*Lanius excubitor.</i>	Great Grey Shrike.
<i>Turdus muscicus.</i>	Song Thrush.	<i>Lanius collurio.</i>	Red-backed Shrike.
<i>Turdus iliacus.</i>	Redwing.	<i>*Ampelis garrulus.</i>	Waxwing.
<i>Turdus pilaris.</i>	Fieldfare.	<i>*Muscicapa atricapilla.</i>	Pied Flycatcher.
<i>Turdus merula.</i>	Blackbird.	<i>Muscicapa grisola.</i>	Spotted Flycatcher.
<i>*Turdus torquatus.</i>	Ring Ouzel.	<i>Motacilla lugubris.</i>	Pied Wagtail.
<i>Troglodytes parvulus.</i>	Wren.	<i>Motacilla sulphurea.</i>	Grey Wagtail.
<i>Regulus cristatus.</i>	Gold-crest.	<i>Motacilla Rayi.</i>	Yellow Wagtail.
<i>Phylloscopus collybita.</i>	Chiffchaff.	<i>Anthus trivialis.</i>	Tree Pipit.
<i>Phylloscopus trochilus.</i>	Willow Wren.	<i>Anthus pratensis.</i>	Meadow Pipit.
<i>Phylloscopus sibilatrix.</i>	Wood Wren.	<i>Accentor modularis.</i>	Hedge Sparrow.
<i>Sylvia rufa.</i>	Whitethroat.	<i>Pyrhula Europea.</i>	Bullfinch.
<i>Sylvia curruca.</i>	Lesser Whitethroat.	<i>Ligurinus chloris.</i>	Greenfinch.
<i>Sylvia salicaria.</i>	Garden Warbler.	<i>Carduelis elegans.</i>	Goldfinch.
<i>Sylvia atricapilla.</i>	Blackcap.	<i>*Carduelis spinus.</i>	Siskin.
<i>Calamodrus schenobenus.</i>	Sedge Warbler.	<i>*Linota linaria.</i>	Mealy Redpoll

The Birds of Epping Forest (continued).

Linota rufescens. Lesser Redpoll.
Linota cannabina. Linnet.
 **Linota flavirostris.* Twite.
Coccothraustes vulgaris. Hawfinch.
Fringilla coelebs. Chaffinch.
Fringilla montifringilla. Brambling.
Passer montanus. Tree Sparrow.
Passer domesticus. House Sparrow.
 **Loxia curvirostra.* Crossbill.
Emberiza miliaria. Bunting.
Emberiza citrinella. Yellowhammer.
Emberiza melanocephala. Black-headed
 Bunting.
Plectrophanes nivalis. Snow Bunting.
Sturnus vulgaris. Starling.
Pica rustica. Magpie.
Garrulus glandarius. Jay.
Corvus monedula. Jackdaw.
Corvus frugilegus. Rook.
Corvus corax. Raven.
Corvus corone. Carrion Crow.
 **Corvus cornix.* Hooded Crow.
Certhia familiaris. Tree-Creeper.
Sitta caesia. Nuthatch.
Hirundo rustica. Swallow.
Chelidon urbica. Martin.
 **Cotyle riparia.* Sand Martin.
Alauda arvensis. Skylark.
Alauda arborea. Woodlark.
 **Upupa epops.* Hoopoe.
Picus major. Spotted Woodpecker.
Picus minor. Lesser Spotted Woodpecker.
Gecinys viridis. Green Woodpecker.
Jynx torquilla. Wryneck.
Cuculus canorus. Cuckoo.
Caprimulgus Europaeus. Nightjar.
Cypselus apus. Swift.
Alcedo hispida. Kingfisher.

Columba palumbus. Ring Dove.
Columbaenas. Stock Dove.
Turtur auritus. Turtle Dove.
Aluco flammeus. Barn Owl.
Asio otus. Long-eared Owl.
Asio accipitrinus. Short-eared Owl.
Strix stridula. Tawny Owl.
Accipiter nisus. Sparrow Hawk.
 **Buteo vulgaris.* Buzzard.
 **Falco peregrinus.* Peregrine Falcon.
 **Falco subbuteo.* Hobby.
Falco tinnunculus. Kestrel.
Phasianus colchicus. Pheasant.
Caccabis rufa. Red-legged Partridge.
Perdix cinerea. Partridge.
Ardea cinerea. Heron.
 **Ardetta minuta.* Little Bittern.
Scolopax rusticola. Woodcock.
Gallinago gallinaria. Common Snipe.
Limnocryptes gallinula. Jack Snipe.
 **Phalaropus fulicarius.* Grey Phalarope.
Vanellus cristatus. Lapwing.
Charadrius pluvialis. Golden Plover.
 **Edicnemus scolopax.* Stone Curlew.
Rallus aquaticus. Water Rail.
Crex pratensis. Corn Crane.
 **Porzana maruetta.* Spotted Crane.
Gallinula chloropus. Moor-hen.
 **Rissa tridactyla.* Kittiwake.
 **Mergulus alle.* Little Auk.
Podiceps minor. Little Grebe.
 **Procellaria leucorrhoea.* Fork-tailed
 Petrel.
 **Procellaria pelagica.* Storm Petrel.
 **Puffinus anglorum.* Manx Shearwater.
Mareca Penelope. Widgeon.
Nettion crecca. Teal.
Anas boschas. Wild Duck.

* Occasional visitors driven into the Forest by stress of weather or other circumstances.

SOME OF THE RARER PLANTS OF EPPING FOREST.

Flowering Plants.

(From the Lists of Mr. Walter Reeves and others.)

Myosurus minimus. Mouse-tail.
Ranunculus auricomus. Goldilocks.
Ranunculus sceleratus. Celery-leaved
Ranunculus.
Arabis perfoliata. Glabrous Rock-cress.
Scabiera didyma. Lesser Swine's-cress.
Tedalia nudicaulis. Common Teesdalia.
Dianthus Armeria. Deptford Pink.
Cerastium quaternellum. Erect Mouse-
 ear Chickweed.
Hypericum humifusum. Trailing St.
 John's Wort.
Hypericum pulchrum. Slender St. John's
 Wort.
Hypericum elodes. Marsh St. John's
 Wort.

Oxalis acetosella. Wood Sorrel.
Potentilla argentea. Hoary Cinquefoil.
**Chrysosplenium alternifolium*. Alter-
 nate-leaved Golden Saxifrage.
**Chrysosplenium oppositifolium*. Oppo-
 site-leaved Golden Saxifrage.
**Parnassia palustris*. Grass of Parnassus.
**Drosera rotundifolia*. Round-leaved
 Sundew.
Dipsacus pilosus. Small Teasel.
**Ozycoccus palustre*. Red Cranberry.
**Menyanthes trifoliata*. Buck-bean.
**Utricularia vulgaris*. Bladderwort.
**Anagallis tenella*. Bog Pimpernel.
**Hottonia palustris*. Water Violet.
Vicium album. Mistletoe.

* Bog or marsh plants.

CRYPTOGAMIC PLANTS—The Ferns of Epping Forest.

(From Mr. James English's List.)

Pteris aquilina. Brake Fern.
Lomaria spicant. Hard Fern.
Athyrium Filix-femina. Lady Fern.
Scolopendrium vulgare. Hart's-tongue.
**Polystichum aculeatum*. Prickly-shield
 Fern.
**Polystichum angulare*. Soft Prickly-
 shield Fern.
Lastrea Filix-mas. Male Fern.

Lastrea spinulosa. Crested-buckler Fern.
Lastrea spinulosa, var. *dilitata*. Broad-
 buckler Fern.
**Lastrea Thelypteris*. Marsh-buckler
 Fern.
**Lastrea Oreopteris*. Mountain-buckler
 Fern.
Polypodium vulgare. Polypody.

* Species thus marked are supposed to be extinct in the Forest, but are likely to occur again. In addition to those above named, the following species are mentioned in Gibson's "Flora of Essex:"—*Asplenium ruta-muraria* (Wall Rue Spleenwort), *Osmunda regalis* (Osmund Royal), *Ophioglossum vulgatum* (Common Adder's Tongue), &c., &c.

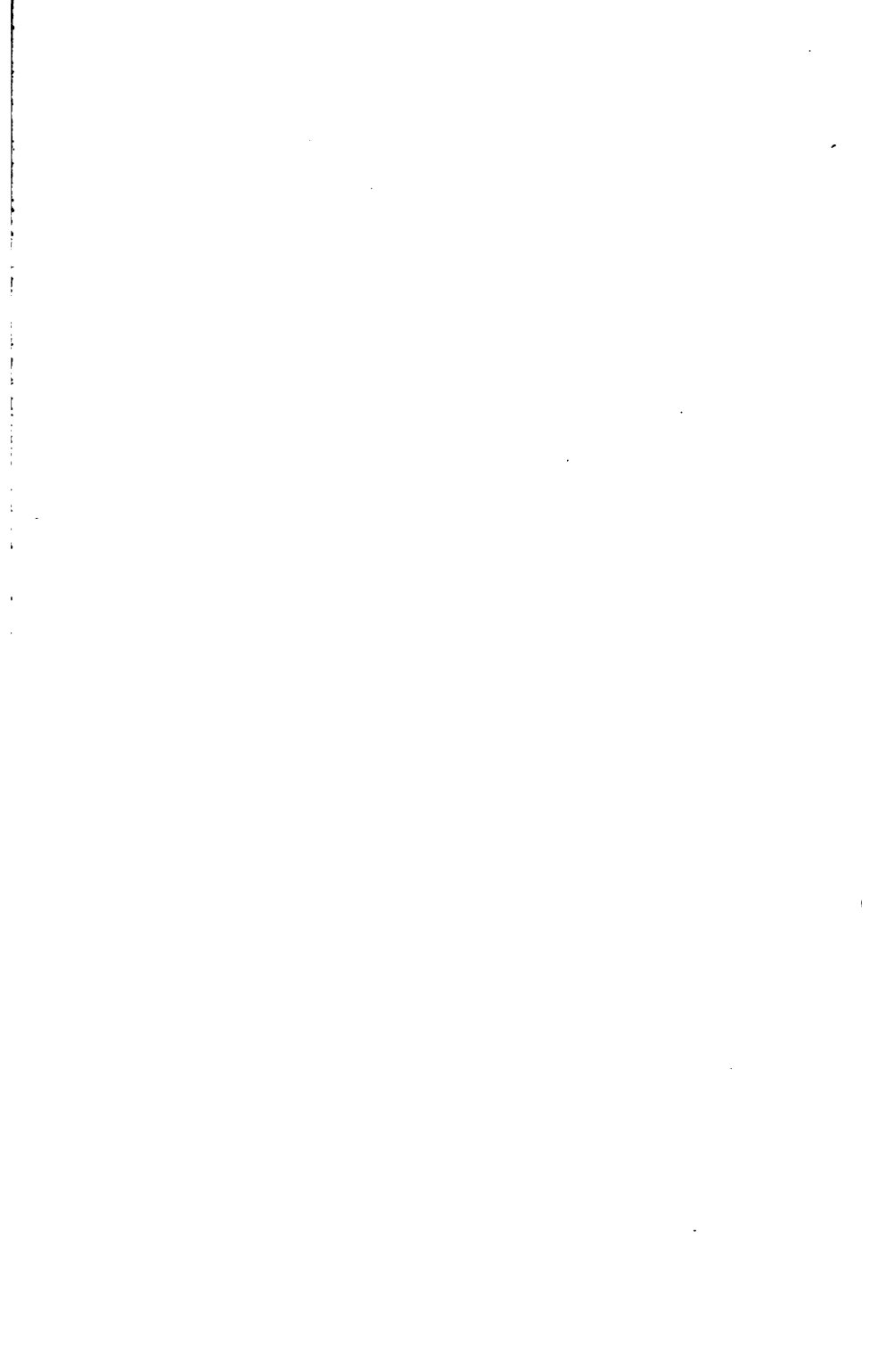
SOME OF THE RARER AND MORE REMARKABLE FUNGI OF EPPING FOREST.

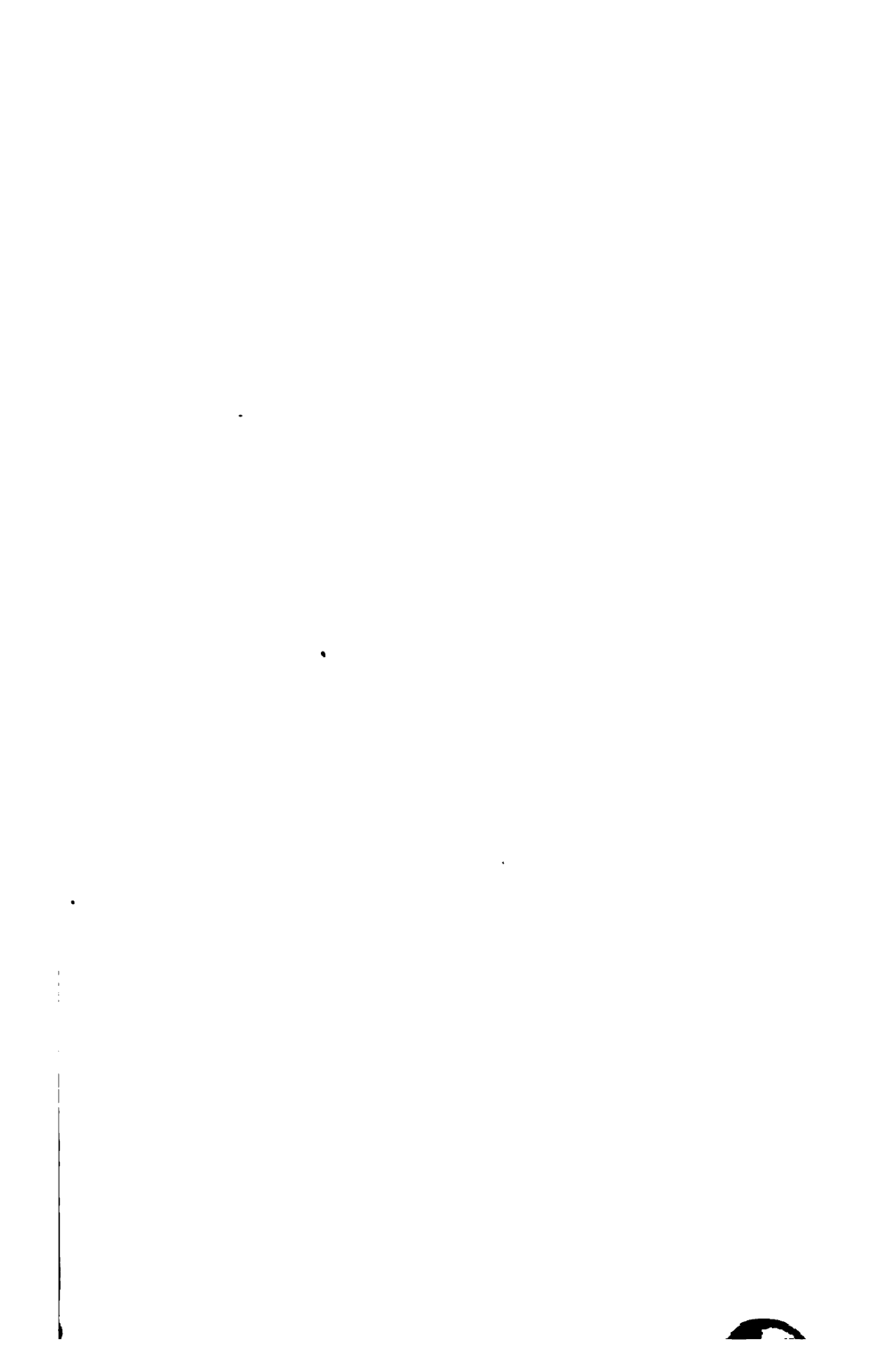
(From Mr. James English's List.)

<i>Agaricus muscarius.</i>	<i>Boletus edulis.</i>
„ <i>mucidus.</i>	„ <i>satanas.</i>
„ <i>splendens.</i>	„ <i>luridus.</i>
„ <i>clavipes.</i>	<i>Polyporus perennis.</i>
„ <i>dryinus.</i>	„ <i>picipes.</i>
„ <i>salignus.</i>	„ <i>intybaceus.</i>
„ <i>petaloides.</i>	„ <i>giganteus.</i>
„ <i>rodicosus.</i>	„ <i>imbricatus.</i>
„ <i>adiposus.</i>	<i>Trametes gibbosa.</i>
„ <i>conissus.</i>	<i>Hydnum zonatum.</i>
„ <i>alnicolor.</i>	„ <i>erinaceus.</i>
<i>Cortinarius cerulescens.</i>	„ <i>cirrhatum.*</i>
„ <i>violaceus.</i>	<i>Radulum fagineum.</i>
„ <i>decoloratus.</i>	<i>Thelephora multizonata.</i>
<i>Hygrophorus chrysodon.</i>	„ <i>clavularis.</i>
„ <i>cosius.</i>	<i>Clavaria fastigiata.</i>
„ <i>Colemannianus.</i>	„ <i>aurea.</i>
„ <i>miniatus.</i>	„ <i>fusiformis.</i>
<i>Lactarius glycosmus.</i>	„ <i>pixillaris.</i>
„ <i>volumus.</i>	<i>Gyromitra esculenta.</i>
<i>Russula virescens.</i>	<i>Helvella crispa.</i>
„ <i>emetica.</i>	<i>Leotia lubrica.</i>
<i>Cantharellus cibarius.</i>	<i>Peziza macropus.</i>
<i>Marasmius urens.</i>	„ <i>onotica.</i>
<i>Lentinus cochleatus.</i>	„ <i>aurantia.</i>
<i>Panus torulosus.</i>	„ <i>sepulta.</i>
<i>Boletus piperatus.</i>	„ <i>hemispherica.</i>

* Believed to be the only British example of this species.

Among the Mosses, &c., found in Epping Forest are *Polytrichum commune*, *P. juniperum*, *P. formosum*, and *P. ferum*; *Mnium hornum*; *Dicranum scoparium* and *D. heteromallum*; *Lepidozia reptans*; *Pottia truncata*; *Hypnum Schreberi* and *H. cupressiforme*, &c.





NG T TO

Cur

iv Rodu

otts.

Hull

Bay
Ch

A DAY'S ELEPHANT HUNTING IN ESSEX.

BY HENRY WALKER, F.G.S.

(*A Lecture delivered May 29th, 1880.*)

I.

SOME OLD GAME PRESERVES.

Each old elephant grins with vast amaze,
While rousing him from his marble hearse,
As a world so new and so strange he surveys ;
And doubtless he thinks that since his younger days
Things are strikingly changed for the worse.

WILLIAM CONYBEARE.

IN the rural sports and recreations to which so many happy Londoners now devote their Saturday afternoons, what outcroppings of the lurking instincts and pursuits of savage man might not the eyes of anthropologists detect ! Below the sober-looking, scientific guise of the modern London naturalist, who starts at two o'clock on Saturdays from "the smoke and stir of this dim spot," for shining river, lake, or glooming woodland (armed with divers wondrous implements and bags of artful make), how much might, perhaps, be traced of innate and ancestral love of hunting—of reversion to the untamed instincts and delights of savage life ! As lambs and kids (so Mr. Darwin tells us) betray their Alpine origin by their fondness for the smallest hillock on which to leap and frisk, so it seems do City denizens, released on Saturdays from artificial life, betray the birthplace of their race by their forms of

recreation. The hunting fields around us in Essex, Middlesex, and Surrey are changed indeed since elephants and aurochs roamed wild along the valley of the Thames; but the hunting impulse still remains. Huge bisons and huger mammoths are now no longer slain between the eyes with the well-aimed flint-stone, as once they were in more arboreal times; but we, the hunters of to-day, still track the giant pachyderms and oxen to their home. In old and well-stocked zoological preserves we well know where to find them, and spoil them, like our ancestors, of horns, and tusks, and teeth, as perchance we shall to-day.

Our trysting place, this Saturday of June, has a name that sounds anachronistic in narratives of mammoth hunting in the valley of the Thames. We meet in Bishopsgate. The railway of these late Post-Pliocene times will take us to these well-stocked zoological preserves of which we speak. Ilford, in Essex (only seven miles from the Royal Exchange), is the spot at which we know our game is likely to be found. But who are we, the hunters, who assemble in such force at this rendezvous in Bishopsgate to day?

A goodly fellowship of London naturalists crowds the railway platform. We meet with veteran geologists as well as amateurs—the fellow-workers once with Buckland, and De la Beche, and Sedgwick—with men

Who know the birth-rock of each pebble so round,
And how far its tour has extended,

—men who willingly lend themselves to teach and popularise their fascinating science. How many Londoners are really addicted to exploring the ancient geography of their favourite City and its environs only appears on a great occasion. The discovery of an old deserted bed of the Thames, with elephant and rhinoceros remains; the finding of a chipped flint hatchet, used by our rude Palæolithic forefathers; a new revelation of the Glacial Drift at Finchley; a fresh “section” in the submerged forest-bed of Plumstead or Malthamstow—such incidents bring out the eager host, the old and young alike, in all their glory. Here

they are, at the railway station, at two o'clock on the Saturday next following the discovery. They have sniffed the quarry from afar, and have come in multitudinous array, and with something of the hunter's zest, to stalk the country. Perchance some lingering game may yet be found, now that the ancient lurking-place has been revealed.

The scene on which we are entering this Saturday afternoon is full of forest history and tradition. What more excites the memory of the history-loving Londoner than the mention of the old Essex forests, whose fragments of their former self still linger near our City? Time was when all the Essex county lay within the bounds of a Royal forest—when the “dim and watery woodland” stretched across from Waltham to Colchester and the sea. What giant specimens of the once abundant forest fauna may not still be found in Essex to tell us of the former grandeur of these wild arboreal tracts! These may be the speculations passing in our minds as our train moves out of the station, and carries us into the heart of Bethnal-green, where, from the viaduct, we look down upon the vast acreage of red-tiled housetops that spread before us. But other topics intervene, and we will not lose the talk of our fellow naturalists, each of whom has some discovery or incident of recent rambles to relate. The microscopical brethren of “The Quekett” tell of researches made on Saturday last in Hackney Marshes—of curious polyzoans found in the Canal, of strange-looking “glochidiæ” and other creatures with fearsome names, and of *Anacharis* (*Babingtonia damnosa*!) choking the brooks. The geologists, too, are full of narrative and anecdote. You hear what places around London are good for field geology—what new gravel pits, railway cuttings, and other excavations have recently been visited, and what fossils from the clay, or sand, or chalk have thus been found. So we soon pass Mile-end Station and find ourselves at Ilford.

Here at Ilford we leave the train, which runs on to Chelmsford and Colchester some sixty passengers the lighter. Ilford itself has something to reward the traveller, who will not look in vain for ancient monuments of man's

device. Here, upon the south side of High-street, is St. Mary's Hospital, an institution of venerable antiquity. We can only stay to hear that the hospital was founded by an Abbess of Barking (*temp.* Stephen) for a prior, a warden, two priests, and thirteen lepers. More, we might learn, but the geologic mind seeks a greater antiquity than this. We leave St. Mary's Hospital to Lord Salisbury, its present warden, and haste to join our fellow-naturalists, who are far in advance on the Barking Road.

The plan of our expedition is now unfolded, and we learn the designs of our leaders. In this Barking Road, we meet Sir Antonio Brady, in whose preserves our game is supposed to lie, and who has hunted the country for years. Sir Antonio kindly brings his carriage for the benefit of the fair huntresses who accompany our party. Perchance a tame elephant or two, with houdahs, and gorgeous caparisons, and swarthy turban-clad riders, are not far off, and will take us to the jungle, or wherever our destination may be. We are well furnished with guides. Besides Sir Antonio, who has tracked a good hundred or more of elephants to their home about Ilford in his time, we have a skilled zoologist from the British Museum, one who well knows the old-world fauna of the Thames Valley and their hiding places.

The word is given by our leaders "To the Uphall Pits on the Barking Road!" To the Uphall Pits on the Barking Road we go. We have time to note the geography of the district. The Barking Road, which runs due north and south, goes down from Ilford towards the Thames, which is about four miles away. The tributary River Roding, at a little distance to our right, runs parallel with the Barking Road. We are on the eastern slope of the Roding Valley.

Suddenly, through a narrow hedgerow gap, our leaders disappear. The game must now be close at hand. Following our leaders, we find ourselves all unprepared among the celebrated Uphall elephant-pits. The flats along which we have walked have reminded us of the rice and paddy fields of Ceylon, but another vegetation here confronts us. In Indian file we thread our way through ranks of well-

hoed potatoes. Thus we reach the brink of one of the pits. Here, still accompanied by the ladies of our party, we begin to descend to the realms below. We reach the lower *terra firma* by a course of wheelbarrow planks. At length we are all assembled, first to receive instructions from our guides, and then to unearth what game we can for ourselves. It now begins to dawn on the minds of the uninitiated of our party that elephant hunting in Essex, in these modern days, is an underground sport—a recreation restricted to the subterranean world and no longer carried on in the open.

We have now descended from the upper air into the excavated bed of some ancient river or lake. It might be misleading, as will hereafter appear, if we said we were standing in the bed of the ancient Thames. And yet these alluvial precincts of the Roding certainly lie within the great shallow trough of what we now call the Thames Valley—that old, incalculably old, line of drainage which has seen so many and eventful changes in the physical geography of south-eastern England. Enough for the present that this excavation is the inlet to the zoological world beneath. But let us be sceptical and take nothing for granted. We are determined to sift to the bottom the strange stories told of these Ilford pits. If we are really standing in an old river-bed, we may demand to see some trace of the various organic remains which a river is always depositing with its sediment. We know that the Thames of to-day is always embedding in its mud some specimens of the aquatic or terrestrial life of the period—the shell-fish that live and die in its waters, and the land animals that are constantly, by accident or design, borne down in the stream. As in some future deserted bed of the Thames, milleniums hence, the fauna of to-day may be disembedded by the Saturday afternoon naturalists of the period, so we, in this Ilford excursion, should expect to discover in the earth around us some relics of the ancient Thames Valley, deposited milleniums ago.

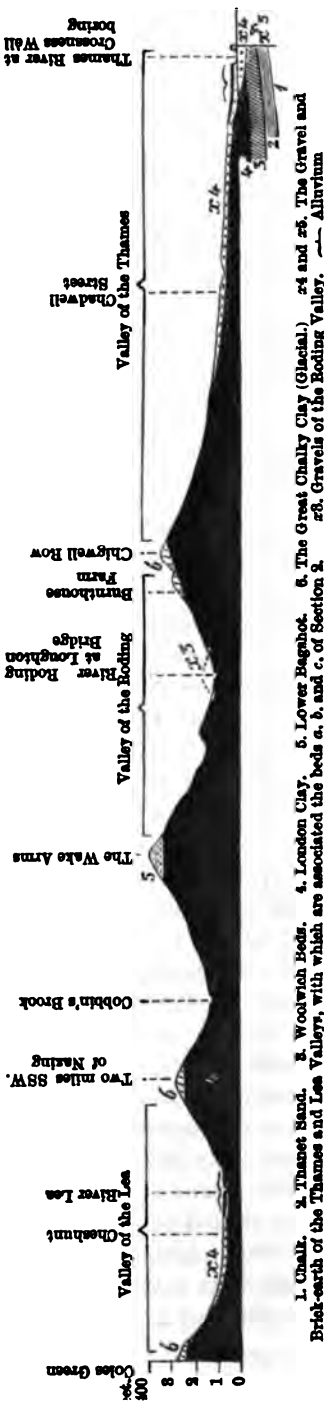
This then is what we see as we stand down below in the pit looking up to the daylight. A perpendicular face of the

Section 6.—SECTION EXHIBITED BY THE UPHALL ELEPHANT PRT. ILFORD, (West Side, parallel with River Roding). DRAWN BY MR. SEARLES V. WOOD, JUN., F.G.S.



a. Clayey Brick-earth, with *Cyrena acuminata* and other freshwater molluscs, underlaid by sandy gravel ("hoggin" of the workmen.)
 b. Bright yellow sand, with *Cyrena acuminata*, and in which, at the point marked by the asterisk on the left hand, occurred the elephant remains found in 1863. (Geol. Mag., Vol. I., p. 348). The black pot holes, marked by asterisks on the right of the section, are due to the denudation of a, and b, prior to their unconformable overgrowth by c.
 c. Newer gravel.
 d. Humus, etc.
 e. Chalk.

Section 7.—GENERAL SECTION TO SHOW THE POSITION OF THE THAMES VALLEY BEDS RELATIVELY TO THE GLACIAL BEDS OF THE MIDDLESEX AND ESSEX HEIGHTS. DRAWN BY MR. SEARLES V. WOOD, JUN., F.G.S.



1. Chalk. 2. Thanet Sand. 3. Woolwich Beds. 4. London Clay. 5. Lower Bagshot. 6. The Great Chalky Clay (Glacial). 7. The Gravel and Brick-earth of the Thames and Lea Valleys, with which are associated the beds a, b, and c. of Section 2. 8. Gravels of the Roding Valley. 9. Alluvium

river-bed rises before us some seventeen feet in height. Running from right to left until they disappear in the unexcavated ground, and pass away beneath modern Ilford, are horizontal bands of different coloured earths. These successive layers of loam and sand and gravel (says our guide) represent successive changes in the sediments brought down by the old and now vanished river which once flowed over the spot. In fact, we here have a lesson as to *how land is made*. Beginning at the base, there is a clayey earth, containing freshwater shells. Then comes a bright yellow sand: this too contains river shells. Above this comes gravel.

The spot is romantic with the dust of ancient zoological races. It is classic in the records of geological research. It was in this very layer of bright yellow sand that the first perfect skull of the British mammoth (*Elephas primigenius*) was found in the year 1863, to the intense interest of the geologic public. It was discovered by the workmen about fifteen feet below the surface. The cranium was nearly entire, the upper portion of the left side alone being slightly injured from the blow of a pick or a spade when the workmen unconsciously came near it. Associated with it were remains of the fleece-clad rhinoceros, great fossil ox, and numerous freshwater shells. Luckily, Sir Antonio Brady was then, as now, close at hand to assist in the difficult and hazardous process of extricating the remains in good condition. The tusk of the mammoth measured eight feet eight inches, from the point to the insertion into the socket. From that time to this remains have been unearthed year by year, and this Uphall Brickfield has thus become celebrated for its fossil relics of wild and wondrous denizens of the early Thames Valley. Not only were fleece-clad elephants and rhinoceroses found here, telling, perhaps, of an Arctic climate in these latitudes; side by side with them, strange to say, have been found the African hippopotamus and elephant—animals of a southern and subtropical clime. What could this mean? Why this astonishing assemblage of animals from diverse climates mingled in one common grave? We shall shortly see.

But all this time the amateurs of our party are getting eager for the sport. Enough of geology. What came they out for to see, but an elephant or rhinoceros dug up entire ! They have read the wondrous story of the Tungoosian fisherman and the mammoth on the shores of the icy Lena ; they have come prepared to assist at a similar scene. They are on tiptoe to carry home some tusk or gigantic tooth as a trophy of the eventful day. But our cool and wary leaders are choosing their time. Before we begin to make search for ourselves, it is well we should understand the conditions of fossil-finding at Ilford, at least as regards the larger *fera natura* of the district.

There is a "close time" for the game at Ilford as elsewhere. In other words, the work of excavation in these pits only goes on at a certain period of the year. In the spring the ground is opened for the purpose of removing the earth, which in the autumn is to be made into bricks. It is then that important zoological discoveries are generally made. In digging out the clay, the workmen come across the fossil remains of elephants, rhinoceros, deer, and other animals mostly of extinct species. These remains are found in nearly every instance scattered over one particular floor on which the great mass of tenacious brick-earth is deposited. The perpendicular section made by the workmen presents the appearance of a wall some twenty feet high, often composed of layers of flat earth, deposited in horizontal lines. Immediately above and about the spot where these animal remains are found, the earth is denser and richer in colour, and is generally arranged in a kind of mound of some feet in thickness. The men are so well acquainted with the indications which tell of the proximity of bones that there is little danger of their destroying the fossils in digging. The principal indication is a kind of fine silver-sand, which is found powdered over the spot, and which crumbles down more readily than the soil above it. The last excavation took place some six weeks ago, and then Sir Antonio was fortunate enough to secure five perfect skulls of the great fossil ox, *Bos primigenius* (the contemporary of the British mammoth), with horn-cores complete.

As no excavations are proceeding to-day (for the workmen are enjoying their Saturday half-holiday), any fossils that we may obtain must be got from the walls of the pit, or the floor beneath us. These relics will not perhaps be of a rare and startling character; but they will, nevertheless, be genuine. Here are some to begin with. Projecting from the wall of ferruginous, finely-laminated, bright-coloured sand is a layer of shells. We all swarm to the spot, ladies included. Hammers, chisels, and "jemmies" are suddenly produced from even the most harmless-looking members of our party, and we are speedily at work as if prising open one of Nature's strong boxes to the tune of—

Hail to the hammer of science profound!
Flint-stone and rock
Quail at its shock,
And their fragments fly as the sparks around.

The fossil dead that so long have slept,
And seen world after world into ruin swept,*
Start at the sound
Of its fearful rebound.

The fossils before us need but little force to compel them to quit their sandy matrix. They prove to be the shells of the little bivalve *Cyrena fluminalis*. They are very brittle, and perhaps to some eyes they may appear somewhat insignificant as trophies of the celebrated elephant bed at Ilford. But they are genuine relics of the ancient zoology of the old Thames Valley—as genuine as the British pachy-

* Alas! for the good old cataclysmic geology, so regnant once in the spectral kingdom of Diluvia and Nightmare, and even in the verses of the period. (See Dr. Daubeny's excellent collection of "Fugitive Poems," Parker & Co., 1869.) It is curious in these more degenerate and pitiful days to see how complacently the catastrophists looked upon the pre-Adamite earth as a periodic slaughter-house on a grand scale. How ruthlessly were successive creations put an end to under that malefic theodicy! Direness was once as familiar to the slaughterous thoughts of the British geologist as it still seems to be to our Continental brethren. And yet every virtuous catastrophist would see in a familiar quotation from Horace at once a prophecy and a rule of conduct in case such a crash should come in his own time:

"Si fractus illabatur orbis
Impavidum ferient ruinae."

derms and deer that have been excavated from the same spot. These identical mollusks, remember, were the contemporaries of the mammoth in Britain! They lived in the waters which the mammoth frequented, as they have since shared his grave for thousands of years. We will consign these precious little relics to the small chip boxes we carry with us for the purpose, and will label them at home with name and place of discovery.

This fresh-water mollusk, *Cyrena fluminalis*, has never been known in British rivers within the historical period. It is now to be found in the more tepid waters of the Nile, whither it must have retreated ages ago, when physical changes of great importance to the biological world began to take place in Britain. It is also to be found in certain streams of central Asia. The visitor to the Uphall pits at Ilford will have no difficulty in securing specimens of *Cyrena fluminalis* for his cabinet. The layer which crops out from the wall on all sides as we stand in the pit is suggestive of a large colony of happy mollusks who found here a good feeding-ground in olden time. A further examination shows that some of them were drifted here in the *post-mortem* stage of their history. The geologist will find shells of *Unio* and *Anodon* as well as of *Cyrena* at Ilford. And he may find land shells (also of the mammoth period), as well as the fresh-water shells we have mentioned. The pretty helix of the woods (*Helix nemoralis*), known to Saturday afternoon ramblers in Epping Forest, is sometimes found in these elephant beds at Ilford with colour-bands looking almost as fresh as we may see them in their living descendants in the hedgerows of to-day.

But suddenly an alarm is given. We are not to invade these sacred haunts of ancient life with impunity. The aborigines of the country have been gradually closing in upon us unseen. They now appear, some of gigantic form, looking down upon us exultingly from the brink of the pit. We are fairly caught—outflanked and surrounded by a wily foe. Not an instant is to be lost. With great presence of mind Sir Antonio, our leader, advances with dignified mien to parley with the chief. It is an anxious moment.

Happily, he speedily returns with good news. The natives are not hostile, but amicable. They are inclined to trade and barter. Better than all, their wares consist of the very spoils we are in search of. They carry with them, wrapped in textures of evidently European fabric, some of the enormous stone-like teeth of fossil elephants, and various gigantic bones. A brisk exchange is soon set up. The specie of the Victorian era, strange to say, is current in the land. One of the best of the purchases is the complete lower jaw of a young mammoth, with the tooth in place. (The junior geologists of our party are much impressed when Sir Antonio pronounces upon it in the vernacular of science:—"Left lower ramus of calf mammoth, with third milk molar *in situ*." Indeed, some of the party were seen surreptitiously writing down the mystic words.) The lucky purchaser of this relic of the juvenile Ilford elephants will be fortunate if he get his prize safely home.

Meantime not a few of our party have resumed hunting for themselves. Some of them have unearthed a few trophies—fragments of tusk (genuine ivory) flaked off a fine specimen too deeply imbedded for present extraction; several molar plates of elephants' teeth, horncores of fossil oxen, and teeth of fossil horse. Soon our palæontologist from the British Museum is as busy as our forefather in Eden giving names to the various animals, as each member, joint, or limb is brought before him by the delighted discoverers. In short, it is soon felt even by the most sceptical of the company that Ilford is indeed a great zoological preserve, and must have a wonderful story.

What this story is, and how it involves the story of Essex, and of a still wider region in times long since gone by, we are now to learn.

.. ..
.. ..
.. ..

II.

THE MAMMOTH AND HIS COMPANIONS AT HOME.

"Stay, you imperfect speakers, tell me more."

Macbeth, Act I., Scene iii.

The curious and heterogeneous assemblage of fossil animals found lying together in one common grave in the Valley of the Roding at Ilford might well perplex and bewilder the beholder. Here on the slope of a little tributary to the Thames, within sight of tall chimney-stacks and railways, and within sound of the roar of the million-peopled city, lie side by side the strangely-mingled remains of wild, uncouth creatures of other climates and unknown times. Some of them evidently belong to an obsolete world. Year by year the number has been enriched by fresh discoveries, and even now the mysterious collection may be incomplete.

But it is time we turned our attention to the problems these remains suggest. How shall we begin the enquiries they force upon us? We shall do well in the first place to look a little more closely at the list of the animals themselves, and see into what groups they may possibly be resolved. The following are the species which have so far been identified and named by our palæontologists :—

Mammoth, or Great Hairy Elephant ..	<i>Elephas primigenius.</i>
Southern Elephant (straight-tusked) ..	<i>Elephas antiquus.</i>
Rhinoceros (fleece-clad, two-horned, stout-limbed)	<i>Rhinoceros tichorhinus.</i>
Rhinoceros (small-nosed, one-horned, slender-limbed)	<i>Rhinoceros leptorhinus.</i>
Rhinoceros (big-nosed, two-horned, slender-limbed)	<i>Rhinoceros megarhinus.</i>
Great Hippopotamus	<i>Hippopotamus major.</i>
Wild Horse	<i>Equus caballus.</i>
Irish Elk	<i>Megaceros Hibernicus.</i>
Stag	<i>Cervus elaphus.</i>
Roe	<i>Cervus capreolus.</i>

Bison, or Auroch	<i>Bison priscus.</i>
Urus	<i>Bos primigenius.</i>
Brown Bear	<i>Ursus arctos.</i>
Grisly Bear.. .. .	<i>Ursus ferox.</i>
Wolf.. .. .	<i>Canis lupus.</i>
Fox	<i>Canis vulpes.</i>
Lion.. .. .	<i>Felis leo.</i>
Beaver	<i>Castor fiber.</i>
Water-rat	<i>Arvicola amphibia.</i>

Such is the catalogue of animals which have been disinterred during a series of years from these ancient graves at Ilford. What startling questions they raise! What was the climate and what were the surroundings of this their native land—of these now strangely altered landscapes of Essex and South Eastern England, where the hills and vales are now vocal with domestic sheep and oxen, and where only the badger, the beaver, and the otter are left as the largest of the *feræ naturæ* of these bygone times?

Some of the species found fossil at Ilford still inhabit these islands; others, like the brown bear and the wolf, have lived here in historic times; the fossil bison or auroch of the Essex and Middlesex prairie is hardly distinguishable from the American buffalo of to-day. But what of the stranger forms which figure on the list? What of the northern fleece-clad elephant, the woolly rhinoceros, now vanished from the earth; what of the hippopotamus, the southern elephant, and the lion, which are shown to us to-day only as the captive exotics of the menagerie? How shall we assign to animals of such opposite regions and climes a common area of habitation? Did these creatures really roam wild in natal landscapes in this valley of the Thames? Did they live, move, and have their being amid scenes as orderly as the cosmos of to-day, or shall we assign them, as was done by their earlier discoverers, to a world of confusion and chaos, to the shadowy and horrific Kingdom of Diluvia and Catastrophe?

Our first task, then, is this: *To find in the Essex of to-day some traces of former climatal and geographical conditions under which these animals could have lived.*

THE NORTHERN GROUP OF THE ILFORD ANIMALS.—GLACIAL
ESSEX.

Some of the Ilford animals evidently form a Northern and Arctic group. The warmly-clad mammoth, or woolly elephant, the fleecy rhinoceros, and the brown bear may be taken as examples.* If their presence as the native inhabitants of the land denotes, as it undoubtedly does, the reign of a semi-Arctic climate in Essex, where shall we find in the landscapes around us the traces and memorials of an age of snow and ice—of a long-enduring age of glaciers and an all-enveloping ice-sheet, of icebergs and icefloes ! The answer, as we shall see, is not far to seek.

The Essex hills and plateaux have lately yielded some strange secrets to the explorer. Time was, and not long ago, when the well-known steep of Muswell Hill in Middlesex, one of the leafy "northern heights of London," stood in solitary and mysterious glamour, the only known monument of the great Glacial Period near our metropolis. But to-day the records of the rocks around us are more plainly read. We need not now leave these homely Essex landscapes to find memorials of the Age of Ice in Britain. They are so near to us as to have been long overlooked for those remoter spots of Glacial Britain where "distance lends enchantment to the view." Let us ascend any of the hills north and south of Epping which reach a height of three hundred feet. We lift a patch of the green turf, and what do we see beneath ? The sight is no longer incredible. We look upon the *moraine* of a long-vanished British glacier, lying where it was left ages ago—a *moraine* as real as any that underlie the glaciers of Switzerland and Norway to-day, or the wider-spreading ice-sheet of Greenland. The glacier itself has gone, but here lie its remains, too solid and substantial to disappear with the climate which gave the glacier birth. The strangely commingled wreck and *débris* of rocks, and fossils, and masses of earth brought here from distant areas, are all before us ; they stretch for many a mile beneath the grass.

* The musk-ox and the reindeer should also be taken into account, inasmuch as they are found in the Thames Valley, though not at Ilford.

In the pits of the tile-kilns at Epping, in excavations near Woodford, at Theydon Mount, and at many a spot "familiar long but never truly known," the daylight has now been let in upon the long-buried scene. The dried glacial mud, the transported rocks and fossils and masses of earth, may be seen and handled for ourselves. At Epping we find, almost as abundantly as at Finchley, the transported spoils of the Oolitic and Liassic districts of England. We may identify almost to a certainty the morainic accumulations of the land ice which once, stretching from the chalk wolds on the east to the flank of Charnwood Forest on the west, came down the eastern side of England from the mountain districts of the north. We pick up at Epping and Finchley alike, the well-known incurved shells of the *Gryphea*, the curious belemnites, and the hard pebbles and pellets of chalk from the Lincolnshire rocks which were abraded by this ice to furnish materials for our Essex and Middlesex boulder clay.

These solid memorials of a former climate, and of terraqueous arrangements strangely different from those of to-day, are yet only remnants of the once far-spreading phenomena. Nature, as we shall see, has perpetuated on a larger scale her achievements in the Glacial landscapes around us.

RANGE OF THE ESSEX GLACIAL BEDS.

The extent and range of the Great Chalky Boulder Clay, which is to explain for us some of the mysteries of the Ilford elephant pits, has at length been fairly determined both in Essex and elsewhere north of the Thames. North of Epping it extends for many miles in an almost unbroken sheet. From the eastern brow of the Valley of the Lea in this northern area to the mouth of the Chelmer we may travel on foot without once leaving Glacial ground. Beyond the northern borders of Essex we should trace it stretching through the Midland Counties to the chalk wolds of Lincolnshire. As we come southward to the Valley of the Thames, we are introduced to a later chapter in its history. Broken and discontinuous, it becomes still more

patchy ; and at length it disappears *where the slope of the valley begins*, and here we meet the records of a later period—records which did not begin until after this great sheet of ice had disappeared in our south-eastern area of Britain.

The memorials of glacial Essex of which we thus get a glimpse on the hill-tops and plateaux take us back to the climate and time of the northern group of the Ilford fossil mammalia. We have got back to the age of the mammoth and woolly rhinoceros. It was a long enduring age in Britain, and marked by many eventful and complex phenomena. But we need only look at the later stage of this incalculably long period, and witness, as it were, the incoming of the more varied fauna with which we find these northern animals associated in the fluviatile graves of the Roding Valley.

BEGINNINGS OF PLEISTOCENE ESSEX.

At the time when the ice thus prevailed, the land—except the summits of the most elevated districts, as the Knockholt Downs, which as we look south from the Essex heights appear projected on the sky-line—was for an untold period of time lost to view beneath the sea. It suffered the slow but sure spoliation and destruction of all vegetable and animal life by that wonderful vicissitude the Great Marine Submergence. Gradually sinking beneath the waters, this part of the land-surface of Pliocene Britain, with its forests and pastures, and all the varied animal life of the period, its river courses and all terrestrial features, became a sea-floor. Here in this submarine condition it was overlaid as the slow years went on with the sediment and drifting waste of the sea, with the dropping *débris* transported from land still above the waters, and with its own looser rocks drifted to lower levels.

As the land sank, and again as it emerged, pebble-beds and gravels we see around us to-day were disturbed and spread over wider areas, gathered in the submarine valleys, and mingled with the mud and sand. The former hills and plains of heath-clad Essex were wasted and

lowered in height, and the contours of the old land-surface defaced and wrecked. Though hidden from sight, submarine England had a history of no little import for the soils of the future land-surface. At length, on rising slowly from the sea, as islands and future continents are rising above the waves to-day, the emerging land appeared with many of its old valleys and river courses choked up with sand and gravel and overspread with the *moraine* of the ice, its bolder mountain ranges and hills worn or effaced, its minor contours obliterated. But the greater watersheds survived the long-protracted waste: they began to resume their functions in the slowly enlarging area of the landscape.

Thus the larger of the ancient river valleys began to be excavated afresh, and so the post-glacial Thames may be an old river valley in part re-excavated, increasing in width and depth as time went on.

The Lea, the Roding, the Thames, belong then to the period which succeeded this great marine submergence. They were the gradual effect of the atmospheric forces which are always at work on a terrestrial surface, sculpturing it with hydrographical contours, and so forming the hills and valleys of the landscape.

But the land rose from an icy sea. The ice, which had covered so large a part of the eastern and north midland counties, retreated to the valleys of the mountain district of the north of our island. East Anglia and Essex emerged first from the waters, for here the submergence was only a few hundred feet. How long the ice of the Chalky Clay had held possession, excluding the return of vegetable and animal life, we know not. Nor do we know how long the land continued to be an island, or a group of islands. It gradually became poorly stocked with the beginnings of vegetable life, with a meagre herbaceous vegetation of mosses and lichens. It was visited sometimes by sea-birds, and in the severer winters by a few Arctic land animals—by lemmings, hares, voles, and foxes, crossing the frozen straits of Dover. It was only by so continuous and persistent a rise of the land as would unite it with the continent

of Europe that a more varied flora and fauna could advance. But that time had not yet arrived. The humbler but not insignificant herbaceous plants were the prevailing vegetation, and then began to flourish the reindeer moss, the branching "cladonia" which has ever since lived on our heaths and commons, reminding us to-day of the British reindeer that in time found its way to the glacial Essex hills.

THE GREAT EUROPASIAN INVASION.

And the time of more habitable conditions did arrive. Gradually the rising land was more and more uncovered by the retreating sea and the northward-shrinking glaciers. Reversions to the old Arctic weather still came on in the winters, but in the summers a giant herbaceous vegetation like that of Siberia established itself. Tall umbellifers, almost rivalling trees in stature during their short life, and coarse but vigorous grasses made an herbaceous forest and feeding ground for the future incoming herds. The land continued to rise: the German Ocean, from which the waters had now retreated northwards to the outlying depths, became a land-valley, and the westward and northward-travelling herbs and shrubs and forest trees gradually took possession. Southward, the valley of the English Channel had been similarly transformed, clothed with forests and open pastures, varied with mountain and ravine, and perhaps chains of lakes. Far on to the coast of Africa, where no Straits of Gibraltar then intervened, the land was continuous from Britain. Favouring climatal conditions were all that was wanted for the animals of the north and south alternately to visit and occupy each other's land. The rivers of the now united countries watered a common land, those of the British area becoming confluent with those of the continent; the fresh-water denizens of the one were no longer shut off by the sea from inhabiting each other's waters.

By this union of England with the Continent, the great physical barrier to the rehabilitation of the long-lost and long-barren land was now removed. Alternations of climate,

from milder temperature back to Lapland rigours, might occur. The higher vegetable forms might be arrested, checked, and in places destroyed, and the adventurous vanguard of the incoming animals starved or driven back, but the land was now open to the great Europasian invasion. The pine, the fir, and the birch, and turf-forming grasses, self-sown and self-advancing, could now invade the land, ousting the weaker herbaceous forms and preparing the country for the "age of elephants" which was soon to set in. In the rigours of winter the musk-ox foraged the land, and the Arctic rodents—the lemmings, the voles, and the hares—were preyed upon by the fox and the glutton, and when berries and roots had failed by the brown bear. The summers began to lengthen, and the spreading pines and firs were at length discovered by the first company of migrant mammoths. The hardy but less gregarious woolly rhinoceros, with its curious nasal horns, was seen in the land. The wide-spreading *moraine* of south-eastern and central England still stretched to the glacier foot on the mountain districts of the Pennine, but in Essex and Middlesex it was now overgrown with forest and prairie, and watered in summer with streams. Across the marshes and through the forests of the former German Ocean, and southward from the future Gaul, the invasion of the great herbivores began. The animals of a more temperate zone succeeded in south-eastern England as the musk sheep retreated northwards. Herds of gigantic bison, uri, and deer, and hosts of rodents came to the newly found feeding-ground. Yet in spite of wolves and lions, the great vegetable feeding mammalia lived and multiplied in the new and congenial home. The mammoth became one of the commonest animals of the Thames Valley; the shed milk teeth of the calf, and the last overworn molar of the patriarch of the herd, are amongst the most abundant fossil remains at Ilford, Grays, Erith, and Crayford. It was the age of the great herbivores, for it was also the age of the yet unrestrained carnivores.* At least two species of wild

* See an interesting lecture by Professor Rolleston on "The Changes reduced by Man in the Indigenous Flora and Fauna of Great

oxen of colossal size were selected and established ; the enormous " Irish elk " was supreme among the cervidae of the period, and other giant animals were on their way to these western feeding grounds and fastnesses. The land had recovered from the depopulation, extinction, and wreck of the great submergence, and the glaciation which succeeded. The great Europasian invasion had begun.

THE SOUTHERN AND SUB-TROPICAL ANIMALS.

We have thus far accounted for the presence of the northern and Arctic group of animals found fossil at Ilford. We have seen the remarkable geographical surroundings amid which they lived, and we may see all around us in Essex the surviving memorials of the climate of the mammoth, and the woolly rhinoceros. The problem presented by the southern and sub-tropical fauna still remains to be considered.

This group of the Ilford fauna consists of the lion, two rhinoceroses (the " leptorhine," or small-nosed, and the " megarhine," or big-nosed), the straight-tusked elephant, the hippopotamus, and the little river mollusk, *Cyrena fluminalis*.

Of this strange collection of British Pleistocene mammalia, the *Elephas antiquus* and the two rhinoceroses are now extinct. The hippopotamus, which in Pleistocene times ranged as far as Yorkshire and has been found in valleys near Leeds, is not now found north of the Nile ; Britain" (Glasgow Science Series, 1878-9). At page 15, the lecturer remarks:—" Modern civilisation, by extirpating beasts of prey, has rendered it possible for us to leave herds and flocks of small oxen and sheep out in the open. In times of ancient savagery, in which packs of wolves held their own, none but big animals would be so left. In those times also, the country was not mapped out by ' formal prope of restless ownership,' and these wild animals had a much wider range, and having better pasturage grew larger accordingly. It is clear that both causes—the presence of wild carnivora, and the absence of enclosures—must have co-operated in increasing the size of the gaminivorous beasts. Those cattle were large because, if a small bull encountered a pack, however small, of wolves, it was pulled down, and there was an end of its existence, and of the chance which it had of propagating small animals like itself."

and *Cyrena fluminalis* seems to-day to be cut off from Europe and Northern Asia by nearly the same barriers as those which confine the great pachydermata. It ranges, at the present day, from the Nile through Syria to the Himalayas and China.

Let us first clearly state what it is we have to explain. The problem is not, How could the musk-ox, mammoth, and reindeer, and the hippopotamus and southern elephant live together in one and the same area during the same year? It is this, How could these animals frequent one and the same area within such a period of time as would account for their being found in a common grave?

Our investigation into the history of the Ilford northern fauna has revealed to us a geographical condition of our country in the Pleistocene period which more than half explains the presence of the sub-tropical species. First, as we have seen, there was in Pleistocene Europe no great physical barrier, such as the modern German Ocean and the English Channel, shutting off England from the Continent. Our land was joined to the Euroasian Continent, and even to Africa. Secondly, MAN, although, perhaps, returning to the re-born land, had not yet multiplied into the communities which have since gradually restricted the range of the *fera natura*, reducing their numbers and extirpating whole species.

The migrant tendencies of animals were doubly favoured in this Continental Period of our land's history. The geographical arrangements were, perhaps, the most favourable that can be conceived for enabling animals to visit the extreme limit of their climatal range, and no great human populations yet disputed their possession.

There were doubtless times when, for years in succession, the glaciers had disappeared, the climate was equable, and summer and winter were no longer marked by wide differences of temperature. That these episodes were not of long duration is shown by the mingling together of the bones of hippopotamus and mammoth in the same level of the old river-beds in which they are found fossil to-day. A

very few years of continuously equable climate would have sufficed for the change of *habitat*. How near Essex and Middlesex were to the southern migrants is shown by the presence of the fluviatile *Cyrena* in the tepid waters of the Thames.*

Such, then, were the geographical conditions and climatal fluctuations in Pleistocene Britain. Familiar as we are with the far different conditions of our country to-day—with the isolation of Britain from the Continent, and the ascendancy of man over the animal world—it is difficult to realise the Britain of this earlier period. Yet this union of England with the Continent, this overlapping in Essex and Middlesex of the range of the Arctic and sub-tropical fauna, exceptional and abnormal as it at first sight appears, may have lasted for a very considerable length of time. It will hardly be doubted by geologists that this continental stage of our country's history far exceeded in

* "When the temperature of the river water was congenial to the *Cyrena* above mentioned it was also suited to the hippopotamus."—Sir Charles Lyell: "Principles of Geology," 10th edit., vol. 1, page 192. In the year 1863 the author of the "Principles" propounded that interpretation of the zoological phenomena in question which is now generally accepted. It is summed up in the last edition of the "Elements of Geology," for 1871, p. 138: ". . . The apparently conflicting nature of the evidence may be due to the place of our observations being near the boundary line of a northern and southern fauna, either of which may have advanced or receded during comparatively slight or temporary fluctuations of climate." A valuable collection of zoological data in support of this view has been collected by Mr. Boyd Dawkins, and is now published in his "Early Man in Britain," 1880. The stratigraphical evidence is a far different matter, involving more difficult and onerous labours, and when this shall have been completed, and the exact succession of geographical events and climatal phases of the period in question be detailed to us, some very important *lacunæ* in the history of the northern and southern fauna of the old Thames Valley will have been filled up.—[In order to show in a general way the relation of the various beds forming the country around Epping, I have given (see frontispiece) five lines of sections which I have taken from a series kindly lent to me by Mr. Searles V. Wood, Jun. The beds numbered 6 and 8 differ somewhat, *inter se*, (in a way which is beyond the scope of this lecture to describe), but they bear that relation to 7 which their numbers import.]

duration the few thousands of years which make up the poor sum of the so-called historical period.

THE SITE OF THE ILFORD GRAVES.

The kind of hiding-place in which these old British quadrupeds are found deserves to be carefully noted. The site of the Ilford graves will help to tell us in what particular physical areas of our landscapes we may expect to find similar memorials of Pleistocene Britain; they may put us on the track of fresh discoveries.

Let it be noted, then, that these strange relics—these remains of British bison and gigantic deer, of hippopotami, rhinoceroses, and elephants—are found not on the site of the old pastures and forests of Essex, but in the *old water-courses*. How has this happened?

These animals died the death of all wild creatures in a state of nature. Some were slain by the carnivores, and some, in sickness and old age, retired to the silence of the thicket to die. Some died by the watercourses, and some were swept into the river by floods, and were soon entombed in a natural grave. The greater number would die on the land and leave their remains unburied and exposed to natural dissolution and decay. The bones which the hyenas spared would lie bleaching for a few years, and soon perish and disappear from natural decay. Of the skeletons thus exposed, nothing would be left to tell us that these animals ever existed.

How has it happened, then, that this interesting group of Pleistocene mammalia has been so wondrously preserved? The answer is readily given, if we but look at the function of a river valley in the economy of the land surface.

A RIVER VALLEY AS THE HISTORIAN OF THE LANDSCAPE.

Our old river valleys cannot fail to be rich in relics of the physical and zoological history of the countries which they drain. The Thames and its tributaries may well be rich in memorials of the physical and zoological history of south-eastern England. From the time when the present

land-surface arose above the icy waters, and began to be sculptured into water-sheds and river-basins, down to these latest days, such valleys have served as great hiding-places and storehouses for the varied drift of the landscapes which drain into them.

From the deposits of our old rivers we learn the kind of denizens which dwelt on the adjacent snow-clad hills and plains, or among the forests, jungles, swamps, and prairies of mammoth-haunted England. During long and eventful ages, marked by great changes in the climate, zoology, and physical geography of our land, the rivers have entombed and treasured up the drift of the wide terrestrial area around them. They have thus preserved, until future ages, many a relic which would have been left to decay or sudden destruction on the land, had it not been swept by floods to the care and custody of the valley.

In this way the rivers were acting as the chroniclers of physical England long ere human historians appeared. In ages long antecedent to the annals of man, the Thames was storing its valley with that wondrous archæology of Nature which we to-day in weekly rambles are privileged to explore. Through an incalculable long period, marked by changes in the climate and the separation of Britain from the Continent and by the dying out or dispersal of old-world forms of life, the Thames and its tributaries, from the Cotswolds downwards, have been pouring their waters down to the great receiving-drain of the lower Thames Valley. And so to-day we learn from these involuntary chroniclers what strange inhabitants dwelt in this Essex country of ours, fellow-denizens with man, and yet of whom man himself has left no record.

These river graves at Ilford and Grays Thurrock are to the Londoner what the limestone caves of Victoria, Kirkdale, and Torquay are to the inhabitants of Yorkshire and Devonshire. They are a natural museum of the mammoth and rhinoceros period in England. In the valley of the lower Thames, the rocks are not of the limestone texture which elsewhere has been gradually hollowed out into caverns and fissures to serve as sepulchres for our old

British mammalia. In our region of softer rocks, the river valleys perform the preservative and historic functions of the hyæna-dens and bone-caverns of northern and western Britain.

III.

THE CAPTURES.

Yours, yours are the culpable shoulders
That bore off our bones from the quarries, to raise
Amazement and fear when exposed to the gaze
Of featherless biped beholders.

—HORATIO SMITH (*Daubeny's Fugitive Poems*).

Our pursuit of the feral denizens of the Thames Valley this summer Saturday afternoon has been so exciting, that we now find we have unwittingly been led on from familiar tracts of Essex scenery into a new and mysterious geographical region. In vain we seek to recognise the scene before us as belonging to modern or historical England. A new and hitherto unmapped arrangement of land and water stretches far away, and the animal world that dwells around is wonderfully diverse from that we have hitherto seen. We are still, it would seem, in the country of the Thames Valley; but the tame and placid stream which a moment since was winding unseen in the valley below us, full four miles away, suddenly arises before us as a wide and impetuous river, that comes swelling up the shore till its waters lap our feet. With torrential volume it brings down from its inland course the terrestrial spoils of the country it has devastated—the carcasses of mammoths, gigantic deer, and British rhinoceroses, whose fellows are tramping and browsing in these aboriginal woodlands around us. Huge shaggy aurochs and great-horned uri, far-off ancestors of the gigantic oxen that the Romans saw when they first invaded the wooded wilds of uncivilized Europe, are

Crushing the forest in their race,

and sharing again with the woolly-clad elephant and rhinoceros these gloaming Essex wilds.

Such is the vision we get of the country of the ancient Thames Valley in this our Saturday afternoon ramble at Ilford by descending some twenty feet down into the old and deserted bed of the river on the Essex shore.

But to our story. The great annual elephant-hunt in the Ilford district of the Thames Valley came off about six weeks before our arrival. On that occasion, although no elephants were taken, no less than five head of bison rewarded the prowess of Sir Antonio Brady and his party. These creatures were of a celebrated and historical species. It was the huge shaggy bison, and the great horned urus, we remember, that startled the Roman soldiers when first they penetrated the forests of Germany and Britain. These wild and primitive European cattle were occasionally captured and exhibited alive in the shows of the Roman amphitheatre. They are described by a modern poet, in the well-known lines,—

Mightiest of all the beasts of chase
That roam in woody Caledon,
Crushing the forest in his race,
The mountain bull comes thundering on.

Sir Antonio may well feel proud to have bagged such rare and notable creatures as these. We who have come down from London to-day can hardly expect to enjoy such sport as this. The gigantic game of the Essex wilds has been thinned by so recent an invasion of these famous geological preserves, and we find ourselves left to unearth the smaller prey that may still be lurking around. But the game which we have so far bagged, humble as it is in its powers of resistance, will at least serve to commemorate an afternoon spent in this wonderful country for the sportsman and naturalist, the old Thames Valley.

So far, then, our afternoon's sport in these old Essex hunting-grounds has not been marked by moving accidents or hair-breadth 'scapes. As yet, no tusky thick-skinned monarch of the herd has charged us through the hedgerows, trumpeting furiously with proboscis aloft, to avenge our intrusion; nor as yet have any of our *cortège* drawn their tulwars ready if needs be to ham-string the monster on his

way. But it is too soon yet to sum up the events of the day. We are still in the region where scores of elephants have been traced by our leader, Sir Antonio, during his residence in Essex, and some wonderful sights and sensations may yet await us.

The signal is given to withdraw from the Uphall field, and to hark back towards Ilford. On the London road, just beyond Ilford, are some game preserves which have been explored with great success in previous years. Towards Ilford, then, we go along the Barking road. The landscape scenery, might we linger to enjoy it, would doubtless charm us with something of idyllic beauty. All around us the peaceful aborigines of Ilford pursue their wonted toil. Their life's employ would seem to be the cartage of manure. This staple industry of modern Ilford engrosses all the rural population. They stack the precious tilth in massive banks along the road, and seem to grudge the narrow embrasure in the long unlovely parapet that leads to many a cottage. Such are the charms of the Ilford country in the month of June. But even here the ancient ivory trade would seem to have survived. Some of the natives, suspending for the moment their virtuous husbandry, make advances to us, and seem inclined for exchange and barter. They show us various articles of the elephant traffic, which seems to form the native wealth of the country. In a few minutes the lower molar tooth of a young elephant has changed hands. The purchaser knows it to be the *lower* molar because the grinding surface is slightly concave, whereas the upper molar is always in the same degree convex. Other ivory ware might perhaps have been offered to us, but the pace of our leaders began rapidly to increase, and we were speedily re-entering Ilford. Here, at Ilford, we find the aborgines assembled at a goat-fair. Goats, it would seem, are the favourite milch-fauna of the district. We push on further, and are able to descry just ahead of us the huntresses of our party. Sir Antonio's carriage is again conveying them to the scene of expected sport. We, the hardier sex, are footing it as we go. The way is longer than we expected, but it is enlivened (as is

usual, we find, in these Saturday afternoon outings) by funny stories—by such stories as hunting naturalists, above all people, seem to love to tell of each other.

Here, on the London Road, just beyond Ilford, is our destination. The game seems to have been driven in at this spot, and surrounded by the hunters, like the shaggy victims of a Norwegian bear-skull, or an Indian elephant-corral. Let us hasten to the spot.

The area to which we are now converging appears to be partly surrounded by a batten fence. The scouts of our party are peering over the pointed staves, and trying to look down into some deep excavation below, as if into a den of wild beasts. Sir Antonio, our leader, with reassuring look, bids us come down without fear into the pit. At length it would seem we are now to be initiated in the mysteries of elephant-hunting in Essex. True, no tame elephants trained for the chase are yet to be seen, or swarthy Eastern riders imported for the day. But let us be patient. A more wonderful venerie than that which is learnt in the jungles of India is now to be taught us. We will let Sir Antonio speak for himself.

This London-road pit, like the Uphall brick-field on the Barking-road, yields to the labourers who work in the ground the bones and teeth of elephant, rhinoceros, and deer. The veritable gates of Hades, leading to a realm of huge old-world forms that once stalked abroad in the upper air in these forests of Essex around us, are these pits in the beds of the ancient Thames Valley. The marvellous story of the finding of these fossil animals, ages after they ceased to exist, and the almost equally marvellous story of the manner in which their almost perished remains are restored, as we see them in public museums to-day, is now related to us in a round unvarnished tale.

As soon as the labourer in the Ilford pits, with pick and shovel and well-trained eye, discovers the signs of organic remains, a messenger is sent to Sir Antonio Brady. Sir Antonio arrives with a skilful assistant, and the work of uncovering the embedded prize is commenced. But the treasure, be it cranium, thigh-bone, or tusk, threatens

rapidly to vanish as soon as exposed to the light. The bones, which have laid here for untold years, have lost their osseous character; they are full of water, and ready to run into a shapeless mass so soon as their matrix is disturbed. How shall they be saved? was a question asked years ago, when the first of these elephant tusks was discovered. It is written in the archives of the time that—

Doctor Falconer to his aid then called Professor Busk in,
And, lo! a mass amorphous they found this precious tusk in!

Another Professor (Mr. W. Davies, of the British Museum) soon solved the difficulty; and now, as soon as the skeleton is exposed, a skilful practitioner is ready with a bucket of liquid size. With this preparation the uncovered bones are speedily coated. Evaporation is arrested, and the fossil is temporarily hardened in view of a more permanent dressing. But the more hazardous work sometimes comes after this investment with size (or, perhaps, plaster of Paris). Suppose the fossil in question to be the weighty collar-bone or cranium of the mammoth—the British hairy elephant! The mass to be removed, including a quantity of the surrounding earth, will amount to half-a-ton, or perhaps 12 cwt. How shall it be raised from its bed, full twenty feet down in the earth, and conveyed entire two miles to the museum which Sir Antonio Brady has provided? Here is the solution. A lofty pair of ship's shears is rigged over the spot, ropes and pulleys are soon forthcoming, and a gang of labourers are speedily working with a will to lift some member, joint, or limb of the embedded elephant out of his grave.

We may form some idea from these few facts of the expense so voluntarily assumed by Sir Antonio, as public and honorary trustee of treasures which, without his efforts, would but too likely be lost to the nation for ever. The wages of a gang of labourers who have been "knocked off" the job of digging brick-earth on the spot where the bones have been found, and who are kept waiting for perhaps three days until the prize is ready for removal, are in

themselves no inconsiderable item. Sir Antonio may well assure us that elephant-hunting in Essex is really an expensive hobby.

And now the grander trophies of elephant-hunting in Essex are to reward our eyes, the spectacle of the various skeletons of elephant, rhinoceros, and deer that have thus been excavated from these fields in the Barking and London-road. We take train at Ilford for Stratford. We soon arrive at Sir Antonio Brady's private museum at Stratford-le-Point, which we are kindly invited to inspect. Here is a brief account of some of the sights we were privileged to witness in this wonderful collection of the old-world zoology of the Thames Valley.

The five bisons' crania which were discovered in the Uphill pits are lying upon a table, and are still enclosed in plaster. They have now to be boiled or soaked in a fluid which shall restore to them the gelatine they have lost during the millenniums they have been buried in the bosom of the earth. This is the process which all the bones and tusks undergo to ensure their permanent hardening.

On the shelves around is a startling display of gigantic skulls and monstrous bones—bones such as Samson might have coveted when an ass's jawbone was his only weapon. Here is a mammoth's tusk ten feet in length. The teeth and jaws represent elephants of every age and size, from the sucking calf with his milk molars, to the patriarch of the herd, whose ultimate molars are so worn down as to be almost useless for grinding his food. Professor Owen has seen a mammoth's tooth that measured *one foot seven inches* in length, following the curve from end to end on the convex side!

The characteristic of the Ilford elephants is the number of the plates in the last molars, which has not been found to exceed 19 or 20, as against the 24, and sometimes 28, found in other species. The largest tooth is 10 inches in length. The spectator cannot fail to be struck with the long spiral curves of the tusks of the adult mammoths, as compared with the almost straight tusks of the more familiar species of modern days. Yet in spite of the enormous size

of some of the tusks, the general evidence shows that the Ilford elephants were rather a small race.

The British rhinoceroses of the Thames Valley are represented by eighty-six remains, belonging to three species, each of which is distinguished by the character or absence of the bony nasal septum—viz., *Rhinoceros megarhinus*, *Rhinoceros leptorhinus*, and *Rhinoceros tichorhinus*. The last-named is characterised by a woolly fleece, like its companion the mammoth. The British lion, which recent geology shows to have been no myth, is represented by the lower jaw and a phalanx of the left forefoot. On the Kent side of the river, at Erith and Crayford, some fine canine teeth of the lion have been found; but these are at present in a private collection at Belvedere. In addition, the Brady collection also includes the hippopotamus, which is found at Grays Thurrock, as well as at Ilford. The ruminants, such as the stag, bison, and ox, constitute fully one-half of the collection, numbering more than 500 specimens. There are 7 specimens of the great Irish deer (*Megaceros hibernicus*) and 50 of the red deer. The task of excavating and preserving the Ilford specimens forms a history of itself, and is honourably associated with the name of Mr. William Davies, of the British Museum. The majority of the bones, on being uncovered, were in a most perishable condition, having had all the gelatine dissolved or washed out, which left them in the state of minutely honeycombed mineral skeletons. Hundreds of fragments of a single bone have been restored to their original position by Mr. Davies, and gelatine infused afresh, so that the Brady collection is a marvel of art as well as of nature.

These are some of the conspicuous trophies of elephant-hunting in the Valley of the Thames that Sir Antonio Brady possesses. They have all been obtained from the pits at Ilford. It is fortunate for those who have but little opportunity of hunting elephants for themselves that these astonishing specimens have fallen into skilful, wise, and generous keeping. Their custodian is one who has made them the means of spreading more widely a knowledge of the extinct zoology of the old Thames Valley. The museum

at Stratford has now ceased to be a private collection, and the collection may now be seen in the British Museum. The visitor may there see for himself that "Elephant Hunting in Essex" is something more than a phrase, and is really a pursuit that has made substantial additions to our knowledge of the prehistoric inhabitants of the Thames country.

ON THE OCCURRENCE OF THE GREAT BUSTARD (*Otis tarda*,
L.) AND OF THE ROUGH-LEGGED BUZZARD (*Buteo*
lagopus, Gm.), NEAR CHELMSFORD, DURING THE
WINTER OF 1879.

BY R. M. CHRISTY.

(Read February 28th, 1880.)

As Dr. Bree observed in the *Field* a few weeks ago, one hears strange things this winter, and stranger, perhaps, than all else have been the variations of the weather. A year of almost unprecedented meteorological phenomena closed with a month of still greater weather disturbances, not the least remarkable being the excessive frost on the night of December 6th. An account of the meteorology of the year 1879, and its consequences, includes an account of many of the catastrophes and events of that year. It is probably to the vagaries of the weather we must look for an explanation of the unusual fact that during the month of December last a *Great Bustard* was actually shot in our county.

The occurrence of so interesting a bird, and the fact that no minute account of its appearance has hitherto been made public, prompt me to present this note to the members of our County Club, as it seems to me they are the persons who should take most interest in the case. Our rare and distinguished visitor was (of course) *shot*, so that we cannot boast of having received it in a very hospitable manner; and the only reparation we can make is to record the visit, and thus perpetuate its memory.

The facts of the case are as follows:—On the morning of Friday, the 5th of December last, soon after daybreak, Mr. Albert Pertwee (of Woodham Ferrers) was laid up close to Hull Bridge in that parish on the north side, and

under the wall of the River Crouch, for the purpose of shooting wild-fowl. While thus stationed he was surprised to observe a very large bird fly leisurely over the river and then over his head at but a very little height. His gun being loaded with No. 2 shot, he fired and brought it down, although but slightly wounded. At first he had no idea of the name of the bird, but it turned out to be a *Great Bustard*.

For the benefit of those who are not ornithologists I will here make a few remarks on this interesting species. So far as our own country is concerned, the Great Bustard is now almost extinct, the dawn of the present century having seen very nearly the last of it as a resident in these Islands. Indeed, one might say that it was even then quite extinct. Those stray specimens that have been met with during the last eighty years or so have been birds driven by accident or stress of weather from the Continent, where, under more favourable conditions of existence, it is still no very great rarity. During the last and the preceding centuries it might even have been called a common bird, especially on the wide open downs in Wiltshire and Sussex, and various places in Norfolk. In Gilbert White's time it was probably not a bird of every-day occurrence, for he says under date 1770: "There be bustards on the wide Downs near Brighthelmstone." A quaint and primitive natural history work which I possess* speaks of it occurring in the places mentioned, and also on Royston and Newmarket Heaths in Cambridgeshire, but admits that it was once far more common in England. The book contains a fairly good figure of the bird. I will quote a few lines describing the mode of taking them then employed:—

"Where there are neither woods nor hedges to screen the sportsman, they enjoy a kind of indolent security. . . . But though they cannot be reached by a fowling-piece, they are sometimes run down by greyhounds. Being voracious and greedy, they often sacrifice their safety to

* "The Naturalist's Pocket Magazine, or Compleat Cabinet of Nature." London, 1799 and 1800.

their appetites ; and as they are generally very fat, they are unable to fly without much preparation : when, therefore, the 'greyhounds come within a certain distance, the bustards run off, clap their wings, and endeavour to gather under them air enough to rise ; in the meantime the dogs are continually gaining ground, till at last it is too late for flight. However, notwithstanding the sluggishness of their usual pace, they can, when in danger, run very fast, and once fairly on the wing are able to fly several miles without resting." There is a gentleman here at Chelmsford whose grandfather, then resident in Norfolk, used to keep greyhounds for the purpose of coursing bustards.

The pages of the *Zoologist* have recorded a few specimens from time to time, but in rapidly decreasing numbers, and, if I remember rightly, there have been no records for several years. This will show the interest attaching in a visit once more from the Great Bustard, and perhaps justify a rather lengthy notice of it.

The Essex specimen was brought by its owner, on the day of its death, to Chelmsford Market, and deposited for a time with our local bird-stuffer. Here it was fortunately not destined long to remain. Mr. Pertwee, who valued it but slightly, not being a naturalist, after some hesitation parted with it to my friend Mr. C. Smoothy, of Bexfields, Galleywood, near Chelmsford—a very good ornithologist and an amateur taxidermist of more than average pretensions—to whose already extensive collection of rare birds, all preserved by his own hands, it forms a grand addition. It is a matter for congratulation that instead of being roasted like a turkey by some ignorant nineteenth-century heathen, it has passed into the hands of a person knowing so well how to appreciate it as Mr. Smoothy, who would, I know, be very pleased to show it to any member feeling interested enough to call upon him. There seems to be some doubt as to whether it is a young male or a female bird, but probably it is the latter. Whether this is the case or no, it has not the imposing size and conspicuous beard of the adult male, and only weighed about ten pounds ; the average weight of the male being twenty-five

•

pounds. Its total length was about 3 feet 9 inches, and the utmost expanse of its wings exceeded seven feet.

So far as I am aware, there is no distinct and authentic record of the occurrence of the Great Bustard in Essex; but Mr. Smoothy recollects being told, many years ago, by a very aged farm-labourer, that he had once known of a nest here; and there is a hamlet called *Bustard Green* not far from Dunmow. Yarrell, too, mentions an advertisement in the *Spectator* for 1712, where an estate is to be let at Heydon, near Saffron Walden, with "woods of large timber where there is all game, even to the pheasant and bustard." The probability is that in its time the bustard was not a very rare bird here; but I should not imagine that it was ever abundant. Our county has not now, nor has it had for a very long time past, those large open and uncultivated tracts of land which form the strongholds of this species.

A report reached Mr. Smoothy that Mr. Wiseman, of Paglesham, had a bustard lately killed there, but on investigation it turned out to be a continental specimen.

The interest, however, does not cease with our specimen, for it appears that, early this winter, several were seen in the Channel Islands; and, I believe, on the very same day the Woodham specimen was killed one was observed in Cornwall, and some days later was caught by a dog, but it turned out to be a very weak bird, bearing old wounds.

I do not pretend to have wisdom sufficient to explain the fact of the occurrence of the Great Bustard once more in this country; but if my opinion were asked, I should say the only reasonable supposition is that the weather in France, which was sharper even than with us in this country, disturbed and drove them to seek refuge elsewhere, and that a few wandered to our shores.*

* I have heard of the occurrence of another bustard, not actually in Essex, but just over the county border, at West Wickham, in Cambridgeshire. This bird, during the first days of last February, frequented a large turnip-field on the farm of Mr. William Jonas, who made several ineffectual attempts to shoot it. It was, however

There is yet another rare bird of which I may give a notice, but only a brief one at this time: it is the Rough-legged Buzzard, which was shot by Mr. David Christy, of Patching Hall, near Chelmsford, on December 19th, 1879.

The bird first appeared about the beginning of the month, and from that time forward was constantly seen frequenting the meadows and fields by the side of the river belonging to the Patching Hall and Gutter's Farms, Broomfield, but I was not successful in getting a sight of it. Considering that a bird equalling it in size is but seldom seen here, I do not think it was very frequently noticed, although it seemed to keep to this one spot, and I did not hear of its being seen elsewhere. On one occasion it was fired at, but not hurt, by a relative of mine, as it was hunting a wild duck he had wounded.

During the severe frost about the above date, the ring-doves, being pressed for food, were doing great damage to the cabbages and *rabi*, and more than once the buzzard was observed perched on the same tree with a number of these birds—indeed, it was its acquaintance with them that brought about its death, for on the morning it was killed my uncle had gone out early to shoot ringdoves, and had scarcely put down a couple of decoy birds and secreted himself in his hut before the Buzzard came and perched over his head.

On dissection, I found it to be a female bird, with nothing in its stomach, probably accounted for by the early hour of the day at which it was shot. That it had, in some way or other, contrived to live uncommonly well was beyond all doubt, for I do not ever remember opening any bird having about it such a quantity of fat.

at last shot, on the 6th of February, 1880, by his foreman. I have had the pleasure of examining this specimen also, and find that both in size and colouring it almost precisely resembles Mr. Smoother's bird, but is not quite so brightly marked. The flesh of this one was found to be very palatable by our worthy member Mr. Travis, but that of the Woodham bird was thought but lightly of. I may add that Mr. Travis says that he still knows a very aged man at Saffron Walden who can remember seeing bustards sitting on their nests on Newmarket Heath.

Its bill was of a dark brown colour, cere, legs and toes bright yellow, irides yellowish brown. The head, neck, back, and breast were of a very light colour, indeed almost white, with the exception of a streak of brown down the centre of each feather, and that part of the breast about and between the legs, which was of a very dark brown. The outer primaries were also of this latter colour, but the rest lighter in hue.

All of us will doubtless feel some regret that rare and interesting birds should be shot down almost as soon as seen; but it would be hard to dispute the statement that England is not now in a condition long to support such large birds as the Bustard in a wild state, and we must confess that the ornithologist, with gun in hand, would be sorely tempted to secure such a prize when within reach.

R. M. C.

Chelmsford, February 14th, 1880.

NOTE ON AN ABNORMAL FORM OF *Cardamine pratensis*, L.,
OBSERVED NEAR CHELMSFORD.

By JOHN GIBBS.

(Read March 20th, 1880.)

It was in 1859, twenty-one years ago, that I found in a field in the parish of Widford, within two miles of Chelmsford, some plants of *Cardamine pratensis*, of which the flowers were peculiar, inasmuch as the pistil protruded above the stamens, and, after the other parts of the flower were fallen, was raised upon a lengthening stalk and swelled into the bud of a second flower, instead of becoming a pod containing seed. A specimen of this curious variety of a well-known plant I gave to my friend Mr.

D. Wheeler, to whose kind assistance about that time I am much indebted for the knowledge I possess of plants indigenous to this neighbourhood. That gentleman forwarded a specimen to Professor Lindley, who expressed much interest in it, and wrote a paragraph on the subject in the *Gardener's Chronicle*. Plants of the same abnormal character appeared more abundantly in the same place in 1860; and every year afterwards some might be found. In 1863 Mr. A. Irvine noticed it in the *Phytologist*, having received a specimen from me. In 1870 I sent a specimen to Dr. Hooker, who, in acknowledging its receipt, said that he had seen the same variety both in England and Scotland, and that it was described in Dr. Masters' "Vegetable Teratology." There is, however, some difference between the plant described therein and the form I now notice, in that my plant has a perfectly double flower contained within the valves of the ovary as a calyx, showing a multiplication of petals, as in a double stock or wallflower, but no stamens. The stamens of the original flower, out of which the second one proceeds, commonly appear in due order, but sometimes they are rather petaloid. Thus for more than twenty years, and possibly much longer, has this variety retained its abnormal character as faithfully as if it were that of a species. The year before last I transferred a plant of it to my garden, where it became quite at home and flowered well last spring. In vegetative growth it also showed that reproductive energy which is often found in plants with double flowers incapable of yielding seed. Not only did the flowering stem give origin to branches which, being laid down on the ground, became separate young plants, flowering last spring; but in the autumn the larger leaves which lay upon the ground sent out roots at the bases of their leaflets, while tiny leaves arose above, so as to form young plants capable of independent growth before the leaflets upon which they grew had lost their living green colour. A plant which in such a winter as we have just passed through could live and increase thus may be regarded as very susceptible of cultivation, for which its native beauty and the scientific

interest attaching to its abnormal form would recommend it. The common English name of the species given in the Floras is "*Lady's Smock*;" but the country people of this neighbourhood, especially the children, call it "*Milkmaid*." This abnormal form, growing as it does by nature in the parish of Widford, may therefore well be introduced to cultivation as the "*Widford Milkmaid*."

J. G.

Feb. 19th, 1880.

[In a letter Mr. Gibbs adds—"I have confined myself in the paper to a bare statement of facts, without indulging in the many reflections suggested by them, as to the origin of the form, its analogy with other abnormal flowers of the same natural order, &c. The fact of its growing in the neighbourhood of Chelmsford, within a short distance of the London road, without being noticed by anyone but myself, may encourage us to expect large results from an organized exploration of the several parishes of Essex in search of natural wonders." On the 15th of May last we, in company with our President, had, under the guidance of Mr. Gibbs, the pleasure of seeing the plant growing in its native habitat. It was still flourishing somewhat luxuriantly, and the case appears to be well worthy of careful consideration.—ED.]

NATURAL HISTORY NOTES.

By R. M. CHRISTY.

I.

(*Read March 20th, 1880.*)

On the morning of the 17th ultimo a rather curious occurrence took place here, Chignall near Chelmsford. A rat and a weasel (*Mustela vulgaris*, L.) were caught *together* in the *same* trap, which was set under a barley-stack. On the trap being taken up, the weasel quickly struggled itself free, but the rat was securely held and killed. The trap was set again at the same place, and later in the day the weasel had the boldness to cross it again, but was imme-

diately killed by the springing of the trap. I never remember having heard before of a similar incident, but in all probability the weasel was hunting the rat at the time they were both caught. Although ignorant keepers ruthlessly slaughter these animals, there can be no doubt, from the frequency with which they, as well as stoats, are found when corn stacks are thrashed out, that they do considerable service in destroying rats.

This unusually cold winter has caused not a few of our stoats (*Mustela erminea*, L.) to turn *white*, which is, I believe, not a common phenomenon so far south as Essex. Mr. Smoothy, of Galleywood, saw a pure white one on his farm about a month ago; and the local bird-stuffer has one in his shop very nearly so. On the 4th instant a stoat, mainly white, was put out of a barley stack that was being thrashed at Chignell Hall; and a man told me that he saw this particular animal catch and kill a rat there only a day or two before. Three days later another of our men saw one in a field near our house; he described it as being pure white without a spot. He is a somewhat aged man, and appeared to be very pleased at his observation, saying that, although he had seen such a case before, it was a long time ago.

R. M. C.

Feb. 14th, 1880.

II.

(Read June 26th, 1880.)

THE question, How do wild ducks, moorhens and other such birds introduce their young to the water, when their nests are placed on a tree? is one that has been often discussed, but, I think, never satisfactorily settled.

I have lately been fortunate enough to discover in this neighbourhood two nests, one a wild duck's and the other a moorhen's nest, both placed on trees at a considerable height from the ground. The latter of these contained, when I first found it, nine eggs very hard sat upon, and

was placed at the height of eleven feet above the ground in a hollow formed by the branching out of the bough of a large elm-tree, standing beside a muddy stream in Lord Braybrooke's Park at Audley End. Thinking this a favourable opportunity to observe the manner in which the young would come down, I made many visits to the nest, keeping a sharp look-out for the hatching of the eggs, and frequently saw the old bird leave the nest, although on the first occasion she sat very close, and only left when I accidentally struck the tree with my stick, after having been some minutes below it. The nest was not over the water by five or six feet, and was just visible from the ground. I first discovered it on the 12th instant, and visiting it about seven o'clock on the evening of the 18th, I found that there were five young hatched in the nest and two rotten eggs. I had no sooner got up than one young one, apparently in a fright, rushed to the edge of the nest, took a header, and perished at the bottom of the tree. I directly went home and, returning with a pair of field-glasses, I secreted myself as near to the nest as possible, and watched. One old bird very soon appeared and swam about just below the tree, making a chuckling noise, seemingly as a signal, for the other bird was then seen. Both continued for some time alternately to swim in the stream and walk about at the foot of the tree as though they had nothing particular to do. During all this while the four young left had been keeping up an incessant chirping, and presently I saw something fall, which I had no doubt was one of them. At first the old birds did not appear to notice this; but soon one went to the place, and I could just see the white of its tail above the edge of a hollow in the ground, in which it seemed to be doing something. Having thus watched until it began to get dark, I went up to the tree, and at the bottom found the young one I had seen fall, lying nearly dead; those left in the nest had stopped squealing and appeared to be so weak that they were unable to hold up their heads. I therefore brought one down carefully as an experiment, and set it beside the water, the old birds clucking loudly at

some distance away. Next morning I again visited the nest before six o'clock, and found all the young ones quite dead. The result surprised me considerably; it seemed to be a failure altogether of the bird's sense—a case of complete mistake. The bird built her nest in a place from which she had no power, or at least made no attempt, to remove her young to the water, and all died in consequence.

R. M. C.

Saffron Walden, May 24th, 1880.

III.

(Read June 26th, 1880.)

I SEND herewith, for exhibition at the next meeting, a curious object, which Mr. Travis gave me a week or more ago. A lump of mud, such as it is, does not in a usual way carry much interest along with it; but I venture to think that this case will prove an exception. This strange lump of mud is the work of a Nuthatch (*Sitta casia*), and had it been used to partly close the mouth of the bird's nesting-hole, there would have been nothing unusual about it; but its history is different. It was found a year or two ago in Audley End Park, close to a place where I now know of a nuthatch's nest in which young are being reared. When found it occupied the centre of an old thrush's nest placed out on one of the branches of a large yew tree. The thrush's nest has been now removed, but its lining of rotten wood, &c., still remains adhering to the mud, which, it will be seen, is harder than many a brick, and I notice a specimen of *Clausilia rugosa* sticking in it.

The question arises, What could have induced the birds to fill the old thrush's nest with this earthy structure? It could not have been for nesting purposes; for although the hole in the centre is quite as large as that left by nuthatches in any nest I have seen, yet in the position it was

placed in the thrush's nest, the bottom of the latter would have rendered it impossible for the nuthatch to get inside, much less to set on eggs there.

I shall be glad to hear any explanation of the circumstance, as I confess myself much puzzled with it.

R. M. C.

Saffron Walden, May 24th, 1880.

IV.

(Read June 26th, 1880.)

NOTES as to the health and condition of the various creatures which in a way are under our charge as members of the County Club should at all times be welcome at our meetings. I am sorry to report that I lately procured a fine trout thickly covered with the disease which, when occurring on salmon, is called "*fungus*," and which has lately been working great havoc with that fish in some of the rivers in the north of England. This specimen I first noticed on the 23rd of March last, and resolved, after seeing its state, to remove it. This was in the brook Cann, which runs past our house at Chignal St. James, where there are a few nice fish, but they do not seem to increase much in numbers. It was very sluggish, and would only move a short distance on being frightened. After several ineffectual attempts to obtain it, I at last fired at the fish in a shallow place and killed it stone dead. It must have been by the concussion, however, as not a shot actually touched the fish. It was a very fine specimen, 19½ inches long and weighing 2lbs. 10oz., and very much covered with fungus, of a dirty white colour; at least the half of its entire surface being affected. It was on the back principally, and the dorsal fin in particular. Not being a great angler, I do not possess much knowledge of the salmon disease, but thinking it at any rate to be something new for the disease to attack trout, and that in a little country brook, unpolluted by manufactories and

stopped by no mills, I forwarded my fish to Mr. Buckland for examination. He replied that it was a very handsome trout, evidently recovering from spawning, and covered with a fungoid growth which in external appearance at any rate resembled the salmon disease. He said that the case would be of importance when considering the whole subject of the disease.

It is, of course, possible the plague may disappear, and it is to be hoped at least that it will not spread in the county; but I think it well to send this note to inform members that the disease has been noticed in Essex.

R. M. C.

May 24th, 1880.

TWO NOTES ON THE PRESERVATION OF PLANTS WITH THEIR
NATURAL COLOURS AND FORMS.

BY JAMES ENGLISH.

I.

(Read April 24th, 1880.)

I HAVE been seeking for some simple method for preserving specimens of our wild flowers, with their natural colours better shown than in ordinary herbarium examples. The idea is by no means new. I have seen specimens for ornamental purposes with the colours beautifully retained, but the plants very much reduced in size. The process I suggest is still very imperfect, but I bring it before the Society in the hope that those interested in the subject may aid to develop and improve it, thereby helping, perhaps, to establish a permanent and useful method. At present my plan is as follows:—

1st.—For entire plants, or separate leaves with only green colouration, immerse in a bath of *petroleum*, from *one* to *four* hours, the best time varying according to the delicacy and texture of the plant; drain on absorbent

paper; press in the usual way, shifting if necessary until dry. Before mounting, place the specimens between papers on a board, and "iron" with a moderately warm laundry iron to drive off the superfluous petroleum. Keep under pressure until cool, and then mount for the herbarium in the usual way.

2nd.—In endeavouring to preserve colours, some strange anomalies are observed. Two flowers from different species, but apparently identical in colour, do not show the same result. This is a point most deserving of attention. The yellow and purple Pansies I exhibit were dried in the press, "ironed" with a warm iron, immersed in petroleum, pressed and "ironed" again. On the other hand, the specimens of *Crocus* were immersed at once in the petroleum. The difference in the results is very noticeable.

Of course time alone can test the permanency of the colours; but should any of our members think the process worth a trial, I shall be very pleased to hear from them, and exchange ideas on the subject.

J. E.

April 24th, 1880.

II.

(Read September 25th, 1880.)

At the April meeting I introduced the subject of preserving plants with their natural colours by using petroleum. I soon found it to be a question whether petroleum alone gave sufficient residue on evaporation to effect the purpose in view. I tried various methods to remedy this defect, by adding gum resins, solid paraffin, and other substances, but with no good result. It would be useless to enumerate the failures I have experienced since I took the subject in hand. I worked on smoothly for some time, until new flowers came into blossom, such as *Galium*, *Melampyrum*. These plants, in drying, became quite black, and I was obliged to make further trials.

I then tried petroleum last (*i.e.*, after pressing) instead of first. I found that some kinds of foliage did best in the latter way, but flowers were most successfully dried first, the petroleum being afterwards applied. This I found to be the case almost by accident. I had laid some flowers in the sun; of course they soon shrivelled and dried up, but I was surprised with the brilliant colours they retained. It occurred to me that heat and a powerful absorbent of moisture might be successfully tried. I took ordinary plaster-of-Paris, warmed to about 90 or 100 degrees (F.), and embedded the fresh flowers in it, shaking the plaster carefully down on the plants. This plan answered admirably. Small plants were preserved in less than twelve hours; larger species took longer in proportion to the amount of moisture in their tissues. When taken out of the plaster the plants presented a very dusty appearance, and if left in it too long they became somewhat brittle, but on being laid aside in the air for a time they soon relaxed. They were then brushed with a camel's-hair pencil, and petroleum carefully applied with a brush. Such is the history of the specimens now exhibited, showing well the natural form and colour. Reds and purplish-reds, however, came out too purple. I overcame this difficulty at last by immersing the dried plants in the vapour of hydrochloric acid. About a teaspoonful of acid is put into a wide-mouthed bottle or glass cylinder, and the plants suspended by the stalks, so as not actually to touch the liquid acid; when the proper shade of colour appears they must be quickly removed.

Plants thus dried can be pressed as usual for the herbarium sheets, or exhibited in cabinets, like collections of insects, and would probably be found extremely useful for educational purposes. Some of the more rigid plants can be mounted under glass shades, and they then have a very pleasing appearance, but exposure to the light is very likely to fade them.

It may be well to add that, about three weeks since, a gentleman (an artist) called upon me. He had been travelling in North America, and when in New York he was

shown some flowers preserved by a new process. The method was very similar to mine, but in place of plaster sifted lime was employed, and petroleum was not used. I have tried lime, but I think it will prove to be too caustic, and it is difficult to rid the plant of the dust. However, I think it would be well to give it another trial, and perhaps it may be worth while experimenting with mixtures of lime and plaster.

Mr. Saward has been following me in the same direction, and has helped me in working out the process with equally good results, as his specimens will prove.

J. E.

September 25th, 1880.

FOREST ANIMALS.

By J. E. HARTING, F.L.S., F.Z.S., &c.

(A Lecture delivered to the Club November 10th, 1880.)

A MODERN writer, whose felicitous descriptions of rural life have latterly become familiar to us—I refer to the author of “Wild Life in a Southern County”—has remarked that “one might begin to write a book about a hedgerow when a boy, and find it incomplete in old age.” What would he say of a forest? Whatever his reply might be, it is obvious that, in the limited time at my disposal this evening, it would be impossible for me to furnish anything like a complete account of all that may be seen in a forest by those who know how to observe. Were time of no importance, I might give you some description of the former situation and extent of the vast forests which at one time clothed this island, and of the various wild animals which once inhabited them, but which are now extinct. I might discourse to you of localities where forests of pine have been replaced by trees of a different growth, thus inducing the

succession of a different fauna ; or I might tell you something of those submerged forests the remains of which, upon some parts of our coast, are from time to time disclosed as the tide recedes, bringing to light the horns and skulls of animals—as the red-deer and roe-deer—which, though formerly overrunning a great part of our island, have (except in one or two localities) long been banished from the southern and midland portions of it.

But my object on this occasion is to deal not with the past, but with the present; to bring to your notice some of the characteristic creatures which may be seen in an English forest, not all in one day perhaps, but from time to time in the course of one's excursions. I propose to tell you something of their appearance and habits, and to answer, if I may, some of the various questions which I am accustomed to hear asked concerning some of the less common or little-observed animals.

On proceeding to take a survey of the denizens of a forest, the larger animals, from their size, naturally attract our attention, and we may therefore deal with them first. As it will be necessary, for the sake of clearness, to take them in some kind of order, let me pause for a moment to explain the meaning of the names which have been bestowed on the various groups into which it is convenient to divide them.

We have first the *Ruminants*—animals which ruminate, or chew the cud. They are mostly horned, although there are a few, in other countries, which are not. They are characterized by the absence of incisors, or cutting teeth, in the upper jaw. Instead of these, they have merely a callous pad, against which the cutting teeth in the lower jaw press, and so cut up the food in the same way as meat is cut up by means of a chopper and block.

In order to go through the process of ruminating, they possess a specially formed stomach, or rather a series of stomachs, through which the food passes in turn before it becomes finally digested. It would be easy to explain to you by means of a diagram the exact process which is gone through by a ruminating animal every time it chews the

cud, but it will perhaps suffice if I state only what anyone may observe who narrowly watches the actions of a cow or a deer. The animal first grazes, by nipping off the grass between the cutting teeth in the front of the lower jaw and the hard pad in front of the upper jaw. Each mouthful, instead of being masticated or chewed up, is swallowed at once, and it continues to graze until its hunger is appeased. It then lies down, and the process of ruminating commences. A contraction of the flanks, a spasmodic action in the throat, and the mouth (previously empty) is observed to be filled with the lately swallowed grass which has been forced up into it. The animal then proceeds to chew this between the back teeth, or grinders, with a slow and continuous motion of the lower jaw until the mouthful has become reduced to pulp, when it is again swallowed, and another mouthful is brought up to undergo the same process ; and this goes on at intervals until most of the food swallowed has been masticated.

The canine teeth, or what in carnivorous animals would be called tusks, are noteworthy. In the lower jaw they are always present, though modified so as to resemble lateral incisors ; in the upper jaw they are generally wanting, although in certain exotic species (as the musk-deer, for example) they are enormously developed, and project outwards and downwards to a considerable length.

The grinders are six on each side of each jaw, and so formed that their surfaces wear down unevenly by the lateral movement to which they are subject during the process of chewing ; each tooth (as in the elephant) being composed of alternate layers of enamel—dentine and cementum—which, being of different degrees of hardness, are differently affected by the grinding action.

Another characteristic feature in ruminating animals is, that they are four-toed ; they have neither thumbs nor great toes ; and the feet are so proportioned that the axis of the limb falls between the two middle toes, while the inside and outside toes are much reduced in size, and in some animals (as the camel and giraffe) are lost entirely.

The only Ruminants still to be found wild in our forests are *Deer*, of which we have three species.

There was a time when we had also wild cattle in the forest, but those days have long gone by, and we can now only judge of their appearance from the few scattered herds which are carefully preserved in certain parks.

To turn, then, to the *Deer*: the noblest of them all is the Red-deer, now almost entirely confined to the Highlands, and a few wild districts in Ireland; for, with the exception of Martindale Fells, in Westmoreland, and a certain portion of Somersetshire and North Devon, where it still roams in a wild state, it is not to be met with in England except in a few enclosed parks. And on Martindale Fells, I am informed, the few remaining deer are in a state of semi-domestication. Still they are the original descendants of our wild red-deer, and form a pleasing link of association with the past.

Only a hundred years ago there were red-deer in Cornwall. When Borlase published his *Natural History* of that county, he wrote: "Red-deer are seldom seen in this county; some, however, make their appearance for a time on the hilly downs about Bodmin, whence they haunt the woods upon the moors. They are found in greater plenty in the north, betwixt Launceston and Stratton, as if they were apprehensive of wanting room to range if they advanced into the narrow western parts." *

Carew, who published his "*Survey of Cornwall*" in 1602, regarded the red-deer then in Cornwall as stragglers from the adjoining county of Devon,† and no doubt many of them were stragglers; but Tonkin, in his edition of this *Survey* published in 1811, observes: "We have some red-deer that breed in the inland and eastern parts of the

* Borlase, *Nat. Hist. Cornwall*, p. 288.

† "Red deere this shire breedeth none, but onely receiveth such as in the summer season range thither out of Devon: to whom the gentlemen bordering on their haunt afford so coarse entertainment, that without better pleading their heeles, they are faine to deliver up their carcasses for a pledge to answer their trespasses."—"Survey of Cornwall," p. 23.

county, though not very many." * The fact of their breeding, however, in Cornwall at that date is significant, showing that there must have been a good deal of wild ground well suited to their habits.

Years after Carew's "Survey" had appeared there were still plenty of wild red-deer in Hatfield Chace, and Prynne has left a graphic account of the mode in which they were hunted there in the time of James I. He describes how, for the amusement of Prince Henry, a large herd was surrounded and driven down to the Trent, where they were forced to take the water, their antlers resembling, when close together, a moving forest; how they were pursued in boats by the Prince and his companions, and how the fattest were then selected and killed, and drawn on shore with ropes.

The precise date at which the red-deer became extinct in that wild Chace could only be approximately surmised, for the nature of the country was such as to favour their existing there for a period long subsequent to the event described by Prynne.†

In Lancashire, in the great forests of Bowland and Blackburnshire, there were red-deer until the commencement of the present century. The last herd was destroyed there in 1805.‡

In Gloucestershire, red-deer were introduced into the Forest of Dean in 1842, when two stags and four hinds from Woburn were enlarged. They increased slowly until 1849, when in consequence of the frequent and serious poaching affrays which took place, and the great difficulty in preserving them, all the deer in this forest were ordered to be killed.

Gilbert White's description of the red-deer in Wolmer Forest, Hampshire, must be familiar to everyone. In Queen Anne's time, he says, they numbered about five hundred head; but some years before he commenced his

* Op. cit. ed. Tonkin, 4to., 1811, p. 77.

† See Devon, Issues of the Exchequer (Pell Records), p. 298.

‡ Whitaker, History of Whalley, vol. i., p. 205.

delightful series of letters to Pennant they had dwindled down to about fifty, and he himself saw one of the last that was taken, the survivors of the herd being captured alive by Royal command and removed to Windsor.*

A few red-deer lingered down to the present century (1827) in Epping Forest; and Bell, in his "*History of British Quadrupeds*," speaks of having seen some, many years ago, in the New Forest. They were doomed in 1851.

It would be interesting to trace out the last haunts of red-deer in the various counties of England, and I do not doubt that the inquiry would result in the acquisition of some curious information; but to attempt it here would cause too great a digression.

Those who have not the leisure or opportunity of following the red-deer in the Highlands of Scotland, the wilds of Kerry, or the moorlands of Devonshire, must be content to study them in the few parks where they are still preserved in a semi-domesticated state. It was formerly the practice to keep the red-deer and fallow-deer apart in parks where both species were maintained, owing to an impression that the stags of the former species would kill the latter. Gervase Markham, in his edition of the "*Maison Rustique, or the Countrey Farme*," printed in 1616, says (Chap. xix.):—"You shall not by any meanes in one parke mixe the Red-deere and the Fallow-deere together, for the Red-deere is a masterfull beast, and when the time of bellowing cometh, he grows fierce and outrageous, so that hee will be entire lord of the field, and will kill the Fallow-deere if they but crosse him in his walke; and therefore each must be kept severally in severall parkes."

That such was the practice in the sixteenth and seventeenth centuries is proved by the "*Red-deer Parks*," distinct from parks for fallow-deer, which are found in many of the great places of England, such as Badninton in Gloucestershire, and Grimsthorpe in Lincolnshire, where separate parks for the different kinds of deer were formerly kept up. The present practice appears to be generally to allow both red and fallow deer to be

* Gilbert White, Letter VI. to Pennant.

together, the danger alluded to by Markham having been proved to be exaggerated, if not without foundation.*

The different appearance presented by the stags of the two species is very marked, owing to the entirely different character of their antlers. Those of the red-deer are round, rough and tapering, with three tines directed forward (the *brow*, *bez* and *royal* antlers), and the *cup* or *crown* of three or more points at the end; those of the fallow-deer are smooth and palmated with only two anterior tines (a third being of rare occurrence), and with the hinder margin of the flattened portion of the beam notched so as to form an indefinite number of points. The horns begin to appear at the age of about seven months, when two small protuberances are perceptible; and gradually in the second year straight pointed horns shoot forth. About the beginning of April, before the animal is quite two years old, these fall off at the very root. In the course of the summer another horn grows up, and a broad antler issues from it in a downward curve towards the eyes. At this stage the deer is termed a *brocket*. A year later an additional point is seen on each horn, and the animal is then known as a *staggard*. When another year has passed each main stem is termed the beam, and the whole together is worthy the name of "antler." The animal is now a *stag*. From year to year, should no accident occur, the antlers, which in summer time shoot up anew to replace the old ones, increase in regular gradation and size and branching magnificence, and when each beam bears three anterior tines the animal is called a *hart royal*.†

This casting and reproduction of the horn, growing plant-like on the living animal, is one of the most wonderful phenomena in natural history. It is so curious and wonderful that it would be regarded as a fable were it related of a creature in a distant land which none of us had ever seen. And though the stag is a native of this country, there are probably thousands at the present day who have no correct knowledge of the process. They have

* Shirley, "English Deer Parks," p. 236.

† Boner, "Forest Creatures," pp. 58, 59.

heard that stags "shed their horns," but of the meaning of the words they have no clear idea. Least of all do they imagine that the whole of the strong, thick, solid growth parts at the base from the spot where it grows, and drops to the ground like a dead leaf in autumn. Nor do they know that out of the hard bone there sprouts forth a soft, sap-filled shoot, which grows up like a tree with branches.

The exact time of shedding the horns depends in some measure upon the age of the animal and the temperature of the winter and early spring. They are sometimes shed towards the end of February or beginning of March; but should the winter be cold and spring protracted, the stags shed their horns as late as May—the old ones at the beginning, the young ones at the end of that month. It is very rarely, however, that an old stag is seen with his old horns on after the beginning of May; but a two-year-old deer will carry them for a month or two later.*

In a few days after the old horns have dropped the new growth shows itself, and gradually the new antlers are developed. They are then covered with a thick velvet which preserves the point, as yet soft and tender, from injury. While in this soft condition they are very sensitive, and to avoid injury by striking them against trees the deer leads a life of retirement. In about twelve weeks they are full grown, and as they gradually harden the animal rubs them against a tree to get rid of the velvet. This can only be done gradually, and a stag may often be seen at this time of year with the velvet hanging in strips, being only partially detached from the horns. The weight of the antlers in a full-grown stag varies, according to their size and massiveness, from ten, twelve, to fifteen pounds. This is nothing compared to what antlers used to weigh in former days, a circumstance which must have attracted the notice of all who have examined old collections of deer's heads, such, for instance, as may be seen in some of the royal palaces and ancient halls in Germany. This is to be accounted for by the fact that the deer formerly attained a much greater age than they are now allowed

* Collins, "Chase of the Wild Red Deer," pp. 32, 33.

to do, and they had better and more abundant pasturage than now, when the woods are cut down and the land is highly cultivated. Abundance of nutritious food usually produces antlers of large growth.

I have referred briefly to the character of the teeth in Ruminants. Red deer, both male and female, at one year old have two cutting teeth in the lower jaw; at two years old they have four; at three, six; and at four, eight cutting teeth in the lower jaw. Stags when five years old have two canines, or tusks, in the upper jaw; and occasionally, but rarely, very old hinds have these tusks also, but less fully developed than in the stags.

Deer pair in the autumn, a fact which the stags do not fail to announce by their loud "belling," and by the battles which they fight, when the crashing of their antlers may be heard at a considerable distance. The young are brought forth in the summer-time, when a high growth of fern favours their concealment.

The red-deer very rarely produces more than one young one at a birth.* This is born in June, and, up to the age of three or four months, is spotted with white like a fallow-deer. Gradually it assumes a uniform colour.

With regard to food, deer subsist chiefly on grass, leaves, and tender shoots of trees, beech-mast, acorns, and even fungus. Fallow-deer are very partial to horse-chestnuts; and both species are particularly fond of salt, which they will come a long way to lick when they have once discovered that it has been laid down for them. It is doubtless the saline flavour which attracts them to gnaw antlers which have been shed; and this in some measure accounts for the infrequency with which such antlers are found. Collyns was assured by keepers and hillmen of great experience and undoubted veracity in Scotland that it is a common occurrence for the hinds to eat the cast horns, but he was never able to confirm it from his own experience in Devonshire and Somersetshire. During the past

* So says Scrope, in his "Days of Deer Stalking;" but Collyns mentions three instances in which red-deer hinds produced twins—pp. 48, 50.

summer, however, there appeared in *Nature** a letter on the subject from the head keeper at Bradgate Park, near Leicester, which is very explicit. He says: "There is not the slightest doubt of their eating each other's horns. I have myself seen several cases where both brow antlers and the top points have been gnawed off. I have also seen Scotch heads that have been quite spoiled by the tines having been gnawed, which must have been done after the horn had become hard, and whilst the animal was living."

Before concluding my notice of the red-deer, I may mention a curious circumstance in connection with it. Lyme Park, Cheshire, was celebrated for its fine venison, and formerly the custom prevailed there of collecting the red-deer once a-year—about midsummer or rather earlier—in a herd before the house, and then swimming them through a pool of water, with which the spectacle terminated. This custom of driving deer like ordinary cattle is said to have been perfected by an old park-keeper, Joseph Watson, who died in 1753, aged 104, after having filled that office for sixty-four years. He was believed to have been in his 102nd year when he hunted a buck in a chase of six hours' duration, and is said to have successfully driven twelve brace of stags from Lyme to Windsor Forest.

This reminds me of an anecdote told by Playford in his "Introduction to Music," to the effect that he once met, on the road near Royston, a herd of about twenty deer following a bagpipe and violin; that while the music played they went forward, and when it ceased they stood still; and that in this manner they were brought out of Yorkshire to Hampton Court.

The fallow-deer is so commonly kept in English parks and forests, that its appearance must be familiar to all; and as I have already pointed out the character of its horns as compared with those of the red-deer, I need not pause here to give any further description of it.

It is believed to be not indigenous to this country, and the general opinion is that it was introduced by the Romans. The statement in Bell's "British Quadrupeds,"

* *Nature*, 8th July, 1880.

to the effect that the dark-coloured variety is said to have been introduced from Norway by James I., can hardly be deemed correct. He imported some, no doubt; in 1612* they were landed in Scotland, and were afterwards transferred to Epping Forest and Enfield Chase. But we learn from Leland that there were dark-coloured deer in England long before that date.† Indeed, on this point I have lately come across a much older authority than Leland, who commenced his "Itinerary" in 1533.

Sixty-eight years before that date—namely, in 1465—the Baron Leo von Rozmital, brother to the Queen of Bohemia, visited England, and a most interesting record of his visit, in the shape of an Itinerary written by one of his suite, has fortunately been preserved to us, although, as may be supposed, copies are extremely rare. In this journal, which is in Latin, it is stated that, amongst other places named, he visited Windsor Park, where he was particularly struck with the great number of fallow-deer, which are described as being black, white, and spotted. Thus we have evidence of the existence of this dark variety of fallow-deer in England long before the time of James I.

Another statement, which has more than once found its way into print,‡ to the effect that the spotted variety of this deer was produced by crossing with the axis-deer brought from Bengal by Capt. Gough in 1742, is incredible; the two animals belonging to such widely-different genera, it is not likely that they would interbreed. Moreover, we know, from the Itinerary above quoted, that the spotted variety existed in England in 1465. James I., too, sent some as a present to the King of France in 1608, more than a century before the introduction of Capt. Gough's axis-deer.§

With regard to the reproduction of the fallow-deer, the growth and shedding of its horns, and its food, the

* See Devon's Issues of the Exchequer (Pell Records), p. 150.

† Leland's "Itinerary," vol. vii., page 40, folio 50.

‡ Daniel, "Rural Sports," Supplement, p. 693. Scott, "British Field Sports," p. 380.

§ Shirley, "English Deer Parks," p. 9.

remarks made under the head of the red-deer will, in a great measure, apply; and I need not dwell upon the particular respects in which a difference has been observed further than to note that the fallow-deer not unfrequently has two fawns, and occasionally three, while the red-deer, as already stated, has very rarely more than one.

Modern instances, in which Fallow-deer have been allowed to range freely over unenclosed ground in England, are probably rare. They are seldom seen beyond the limits of a park paling. I may therefore mention one such instance. Longcroft, in his "Topographical Account of the Hundred of Bosmere in the Co. Southampton" (1857), tells us (p. 27) that "the Thicket, Stock-heath, and Leigh Green are the common wastes of the Manor of Havant. The former is a large tract of land containing about 800 statute acres, was formerly a chase or privileged place for deer and beasts of the forest, and till within the last thirty years (*i.e.*, till 1827) a herd of Fallow-deer ranged freely over its uncultivated space. These were preserved by the Bishops of Winchester, who appointed keepers and took every care to keep up the stock. There being, however, *no park or enclosure*, the deer strayed away into the neighbouring lands, and were gradually killed down."

The Roe-deer, one of the most graceful and attractive of forest animals, is in this country almost entirely confined to Scotland. I say *almost*, for in a certain part of Dorsetshire, where this species has been re-introduced, it not only exists, but has increased and multiplied. That it was at one time plentiful in many other parts of England there is abundant evidence to show. I have notes of its former existence in the counties of Northumberland, Durham, Cumberland, Lancashire, Norfolk, Suffolk, Cambridge, Hants, and Devon, as also in Wales, where it is said to have existed until the time of Elizabeth. In Cumberland it certainly survived until 1633, if no later; and in Northumberland the last roe-deer is reported to have been killed near Hexham, in the reign of George I. (1714—1727).

In Dorsetshire it was re-introduced in 1800 by the late Lord Dorchester, who turned out a few pairs in his woods

at Milton, from whence their descendants dispersed in a very short space of time, especially in a south-westerly direction.

A resident in that neighbourhood, Mr. J. C. Mansell Pleydell, estimated last year (1879),* that there were no less than 120 head in the Milton, Whatcombe, and Houghton Woods, which fringe the southern side of the Vale of Blackmore, from Stoke Wake to Melcombe Park and the Grange Wood westward, the number being merely a question of preservation or non-preservation.

The roe-deer was once much more common in Scotland than it is at present, but it is still very plentiful, and has much increased of late years. It is believed that the increase of plantations in the south of Scotland has been the means of spreading it much farther in that direction than it used formerly to be found.

In Ireland the roe-deer is unknown, notwithstanding the statement of Bede, so quaintly contradicted by John of Trevisa; nor have remains of this animal been discovered in the sister isle.

Those who would learn something of the habits of the roe-deer, from one who has had frequent opportunities of observing it, should read the excellent account given in the second volume of Stuart's "*Lays of the Deer Forest*;" nor should they omit to peruse the equally trustworthy account furnished by the author of "*The Moor and the Loch*."

One of the most curious points in the history of the roe-deer, but one on which I need not now enter in detail, is the phenomenon now known as "suspended gestation," and which long puzzled sportsmen and naturalists, until the scientific researches of Professor Bischoff, of Giessen, the well-known embryologist, placed the matter in a clear light. The result of his investigations will be found in the second edition of Bell's "*British Quadrupeds*." Unlike the red-deer, the roe generally has two fawns, and very rarely three have been observed with a doe.† These, like

* See *The Zoologist*, 1879, pp. 120, 170, 209, 262, 301.

† *The Field*, Sept. 2nd, 1871.

the young of the other species, are at first spotted with white.

A pure white roe-deer is a rarity, but is not altogether unknown. One, in the collection of Sir James Colquhoun, was obtained near Luss, on Loch Lomond; and I have heard of others in Germany. Occasionally one may see a female roe-deer bearing horns; but such instances are, of course, not common.* Mr. Duncan Davidson, of Inchmarlo, Banchory, Aberdeenshire, shot a female roe-deer, with budding horns, on the 26th October, 1875; and two other such instances are mentioned in the *Zoologist* for 1866 (p. 435).

The roe is singularly liable to malformation of the horns, and some curious collections have been made of these misshapen antlers.

Before dismissing the subject of Deer, I should like to say something of the various modes of hunting them, past and present, and refer to some of the quaint old treatises which have been written on hunting. But time will not permit, and I must pass on to another, and a very different, group of animals—the *Rodents*, or gnawing mammals; so called from their mode of life, to which the form of their teeth is admirably suited.

So peculiar is the dentition of the Rodents that it is not to be mistaken for that of any other group. They have only incisors and grinders, no canines, and never more than two efficient incisors in each jaw. I say *efficient* because, in the hare and rabbit, and some allied forms, there is in the upper jaw a second pair of *rudimentary* incisors placed immediately behind the front or cutting pair, which never become developed or used.

The position and shape of the incisors proper are remarkable; they have no roots or fangs, but grow from a permanent pulp, and so continue growing through life. Their form is that of a segment of a circle, hence they always protrude from the front of the jaws in the same direction, and meet at the same angle. By this means, as the teeth

* *The Field*, Nov. 8th, 1878.

become worn by gnawing, they continue to grow forward, and so a fresh supply of tooth, so to say, is always maintained. If by any accident (as by a shot or otherwise) one of the incisors should get broken or misplaced, the tooth with which it should come into contact, not meeting with any resistance, continues to grow downwards or upwards, as the case may be, and gradually assumes the appearance of a bony circle outside the mouth, to the great inconvenience of the poor animal, sometimes, indeed, causing death by starvation.

In the case of the rabbit, as many of you have doubtless observed, such malformations are not uncommon. The canine teeth being, as I have said, absent, there is quite a gap between the incisors and the grinders, the latter being so regular and similar in appearance that it is difficult to recognize any distinction of molars and premolars.

The articulation of the lower jaw with the skull is peculiar, for while it results in increasing the power of the incisors or cutting teeth, it prevents much lateral movement of the jaw, and ensures, as much as possible, the meeting of the incisors in both jaws.

I might proceed to point out other peculiarities of structure which distinguish the Rodents from other animals; but I fear to weary you with dry details, and will therefore merely call your attention to the strong and muscular hind limbs which they possess, enabling them to leap and run with great facility and swiftness. They may be said to be all vegetable eaters, although some of the species, like the common rat and house-mouse, are omnivorous.

In the case of such common animals as the Hare and Rabbit, it is not to be supposed that I can say anything very new; but I may assume on the present occasion that there are some who, though perfectly familiar with the outward appearance of these animals, may not have paid much attention to their natural history.

In many respects hares and rabbits, though externally somewhat similar in shape and colour (I once shot a wild rabbit of the exact colour of a hare), are very dissimilar.

Rabbits are born blind, and nearly naked; while young

hares at birth are clothed with fur and have their eyes open. Rabbits produce their young underground; hares construct "a form" above ground. To this general rule, however, exceptions have been noted. Rabbits have been known to breed above ground,* and hares have been observed to burrow.† You may generally tell whether turnips have been nibbled by hares or rabbits by the difference in their mode of attacking the root. A hare will bite off the peel and leave it on the ground; a rabbit will eat peel and all.‡

Hares vary much in weight, and occasionally in colour. The average weight may be between 7lbs. and 8lbs., but I have notes of three, shot in Lincolnshire, in the autumn of 1877, which weighed respectively 11lbs. 3oz., 11lbs. 12oz., and 11lbs. 3oz.§ With regard to variation in colour, I have notes of the capture of three black hares, several albinos, and one parti-coloured one, in different parts of the country.

Black and sandy-coloured rabbits are not very uncommon, but an albino rabbit, truly wild, is, I think, not often met with.

Both hares and rabbits can swim well, but it generally requires the persuasion of the sportsman or his dog to make them take the water. I have only once seen a hare swim voluntarily, and then the stream crossed was not a wide one.

The appearance of the Squirrel must be so familiar to everyone that I need not offer any description, but will confine myself to a few remarks on its habits.

We have seen how one Rodent lives underground, and another makes its "form" upon the surface. We have here a case of one which constructs its nest in a tree, sometimes in a hole, sometimes in a fork between two branches. This nest is made of moss, leaves, and long dry grass, and makes a soft cradle for the young ones, which are born

* See *The Field*, December 2nd and 16th, 1876.

† *Annals and Mag. Nat. Hist.*, vol. v., p. 262.

‡ *The Zoologist*, 1878, p. 100.

§ *The Field*, November 10th, 1877.

naked and blind, towards the end of May or beginning of June, when there is a good screen of leaves, be it observed, to conceal the nest and its owners.

The bill of fare of the squirrel is a very varied one: beech-mast, acorns, nuts, young bark (especially of the birch), the cones of larch and other pines, leaf-buds and tender shoots, mushrooms, fungus, and even truffles are all eaten in turn. In search of many of these it often descends to the ground, and hunts for and digs up the truffle by scent. It lays up a winter store of provisions in some hole of a tree, not relying upon one such hole, however, but filling several in case of accident. Occasionally at least, if not habitually, squirrels will take birds' eggs; and I have noted the testimony of an eye-witness to the fact that they will sometimes also carry off, kill and eat young birds.

In May, 1879, Mr. Thomas Bagnall, of Milton Ernest Hall, Bedford, saw a squirrel in his avenue carry off, kill, and partially devour a full-fledged young Starling, the remains of which he succeeded in recovering.

During a great part of the winter, when the red fur perceptibly changes to grey, the squirrel lies up in a semi-torpid state, coming out on a fine day to feed on some of its stores, and then retiring again.

In answer to the question whether squirrels are injurious to trees, I must reply, "Yes; to some trees; chiefly in plantations of Scotch fir, larch, and occasionally spruce." They attack trees in the spring, between April and June, when the sap is in full flow, biting off the outer bark, and consuming the inner. This stops the flow of sap, which there becomes dry and resinous, and the first high wind blows the top off.

In the same haunts as the squirrel we may find that beautiful little animal, the Dormouse. It is shy and retired in its habits, and must be noiselessly approached if one would observe its movements. It is partial to woods where there is a thick undergrowth to conceal it, and amongst which it makes its nest; but this is sometimes placed on the ground.*

* *The Zoologist*, 1872, p. 2,908.

I once discovered a dormouse ensconced in an old nest of a blackbird, where it had made itself very comfortable in a bed of dead leaves. Although, like other Rodents, it is, strictly speaking, a vegetarian—feeding on beech-mast, acorns, young hazel-nuts, corn, and so forth, during the autumn, and laying up stores for the winter—yet, during the summer, when such food is not to be obtained, it is insectivorous. A tame dormouse, when allowed a run in the garden, would eat the *Aphis lanigera*, and the caterpillars of *Sphinx ocellata*. It was very fond also of the grubs of *Balanus nucum*, the nut weevil, preferring maggotty nuts to sound ones on that account; it would also eat the small caterpillars found in apples and pears.

As its name implies, the dormouse is a great sleeper, and remains dormant during the greater part of the winter. I once saw a pure white dormouse which had been captured at Cowfold, near Horsham, where it is now preserved in the collection of my friend Mr. Borrer.

Two other little animals sometimes cross our path as we take our rambles through the forest—the Long-tailed and Short-tailed Fieldmice. Strictly speaking, the latter is not a true mouse, but a vole (belonging, like the so-called water rat, to the genus *Arvicola*, the members of which are distinguished from those of the genus *Mus* by several well-marked characters).

You may know the long-tailed fieldmouse by his sharp snout, long ears, and long rat-like tail. The short-tailed vole, on the contrary, has a blunt rounded muzzle, short ears almost hidden in the fur of the head, and a short hairy tail. Though very attractive in appearance, and easily tamed, they are, unfortunately, rather mischievous in their habits, and sometimes do a great deal of damage in young plantations by barking the trees.* Fortunately, they are kept in check to a considerable extent by owls, both white and brown, who capture and devour great numbers of them, as I have often ascertained by an examination of their rejected pellets.

* See Jesse's "Gleanings," 1st series, p. 175, and St. John's "Wild Sports and Natural History of the Highlands," p. 67.

Childrey in his *Britannia Baconica*, 1660, relates (p. 14) that in 1580 an extraordinary swarm of Field-mice appeared in Denge Hundred, Essex, and eat up all the roots of the grass. "A great number of Owles," he says, "of strange and various colours [doubtless the Short-eared Owl] assembled, and devoured them all; and after they had made an end of their prey, they took flight back again from whence they came."

We come now to the order *Insectivora*, or insect-eating mammals, of which I have two to bring to your notice as dwellers in the forest, namely, the Common Shrew and the Hedgehog. The animals belonging to this order are at once distinguishable from the Rodents by their dentition. The latter, as I have pointed out, have no canine teeth; *Insectivora* have, and their dentition generally resembles that of the strictly insectivorous bats, the molars, or grinding teeth, being similarly furnished with several sharp cusps or points which are characteristic of insect-eating mammals, and all the teeth have roots or fangs. There are other peculiarities of structure, with which, however, at present I need not trouble you.

From its shy and retired habits, the Common Shrew is not often to be observed in a living state, but may frequently be seen lying dead on the pathway. The cause of the mortality amongst these little animals, though frequently noticed, has never been satisfactorily accounted for; and Bell, in his "British Quadrupeds," has not attempted any explanation. It has been said that their odour is repulsive to their enemies, who will kill but will not eat them; but this is not invariably the case, for I have found numerous skulls of shrews in "pellets" of the barn owl, and once took two of these little creatures from the stomach of a stone curlew.

Of the Hedgehog I might say a good deal, but having so many other "Forest Animals" on my list I must be brief.

Although from its structure and mode of life the hedgehog is properly classed with the *Insectivora*, it is really omnivorous. Nothing seems to come amiss to it. Beetles, worms, slugs, snails, frogs, mice, eggs, young chickens, and

even young rabbits, are eaten by turn as opportunity serves; and on one occasion a hedgehog was surprised with a young leveret struggling in its jaws.* Two that I kept in confinement for some time were particularly fond of frogs.

In this propensity for flesh, the hedgehog resembles the animals which I have next to notice—viz., the *Carnivora*—distinguishable by their immensely powerful teeth (the canines, or tusks, being largely developed), a loose skin, and strong legs and feet, armed with hard sharp claws.

Of this order we once had notable representatives in our forests in the shape of the bear and the wolf, but these, alas! are no longer to be found here; and the most powerful survivors of this group of animals are the badger, the wild cat, and the fox.

The first-named is of special interest as being the sole surviving representative of the bear-family in this country. It is a plantigrade animal, walking upon the entire sole of the foot, like a bear, instead of on the toes only, like a cat. In its habits also and food it resembles the bear, living in holes, laying up by day, and coming forth at night; and feeding on various roots, fungus, earth nuts, beech mast, blackberries, dung-beetles and grasshoppers, snails and worms, frogs and mice. Strange to say, the hedgehog is a favourite morsel, and is easily killed by a badger, notwithstanding its armour. In confinement the badger has been known to devour rabbits greedily; and a partially devoured mole has been found in a nest of young badgers.† I have never heard any accusation against the badger for damaging young trees, nor do I believe that he would do so, his diet being what I have stated. Nor do I believe that there is any truth in the allegation that if badgers are suffered to remain in a fox-covert they will drive the foxes away. Wild animals, as a rule, live in harmony, especially where (as in the case of fox and badger) neither preys on the other.

* *Gardener's Chronicle*, 1846, p. 480.

† *The Field*, March 23rd, 1872.

No apprehension need be felt about the proximity of a badger to a farmstead. He is of a retiring disposition, and will keep out of man's way as much as possible.

Badgers sleep away much of their time in winter, and can go a long time without food. Their footprints are seldom seen in the snow.

Amongst the carnivorous animals which may often be seen hanging up in "the keeper's museum" at the corner of a wood, are the Weasel and Stoat, the latter distinguished by his larger size, and longer tail with a black tuft at the end of it.

Weasels I regard as particularly useful animals, for they destroy a vast number of mice and voles. They should always be encouraged in the stackyard, instead of being caught and nailed up against the barn. Stoats I am not so sure about. They kill rabbits, leverets, and young game birds. Doubtless they kill field-mice too. I have twice seen a stoat carrying a short-tailed vole as a retriever would a rabbit; and I once witnessed a fight between a stoat and a rat, in which the stoat, after a tremendous struggle, came off victorious.

Both stoats and weasels hunt by scent, as I have several times proved by personal observation, and I could relate many curious anecdotes of what I have witnessed. Both these animals swim well, and do so voluntarily. I once had the pleasure of watching an old stoat giving her young one a swimming lesson, and a very entertaining sight it was. They carry their young in their mouths, as cats do their kittens.

The stoat becomes white, or nearly so, in winter; but there is usually a patch of brown on the face, and the tip of the tail is always black both summer and winter.

The weasel very rarely becomes white. I have only seen two that were so: one killed at Willoughby, in Leicestershire, in the winter of 1867; the other in Soham Fen, Cambridgeshire, in September, 1879.

The Polecat (from which the ferret is descended) is now becoming a rare animal in England, and is not often to be seen, so extensively has it been trapped by game preservers

and their keepers. That it is a very destructive animal there can be no doubt, not only to game, but also to poultry, for it will visit the farmyard and henroost, and in one night kill many more fowls than it can eat or carry away.

I once discovered a whole family of polecats (two old ones and four young ones) in a flint cairn not more than fifty yards from a poultry-yard. They were tracked after rain, and the stones being removed one by one, we suddenly came upon a hollow in which the whole family were snugly curled up. One of the old ones escaped; of the rest, four were killed and one was taken alive.

That beautiful animal the Marten, once so common in English forests, is still to be met with in certain parts of the country which are favourable for its protection, but it must be regarded, at least in the south, as one of the rarest of "forest animals." The last killed in Essex, so far as can be ascertained, was trapped by the present head keeper of Epping Forest in April, 1853, in one of Mr. Maitland's covers at Loughton.

Did time permit, I could say a good deal about its distribution and habits, and the former mode of hunting it.

The Wild Cat, which was also a beast of chase in former days, is now believed to be extinct in England, as well as in the southern counties of Scotland.

Mr. Alston believes that none now exist south of the northern districts of Argyll and Perthshire. Mr. Harvie Brown, who has been at considerable pains to obtain information on the point, has come to the conclusion, from statistics which he has collected, that "the wild cat is now extinct throughout a large portion of Scotland, namely, all south and east of a line commencing—roughly speaking—at Oban, in Argyllshire, passing up the Brander Pass to Dalmally; following the boundary of Perthshire, and including Rannoch Moor; continued north-westwards to the junction of the three counties of Perth, Forfar, and Aberdeen; thence across the source of the Dee northward to Tomintoul, in Banffshire; and, lastly, from Tomintoul to the city of Inverness. Northward and westward of this

line the animal still keeps a footing in suitable localities, finding its principal shelter in the great deer forests."

The Fox, with which species my list of "Forest Animals" closes, is so well known in appearance and habits that I need not trespass further on your patience by describing an animal so familiar to you.

In conclusion, I would express the hope that the remarks which I have made this evening may be the means of inducing many of my listeners to visit the forest and observe for themselves, not only to test the accuracy of what they have just heard, but to discover fresh points in the natural history of our forest animals upon which I have not had time to enter.

THE PRESIDENT'S ADDRESS

Delivered at the Annual Meeting, January 22, 1881.

BY RAPHAEL MELDOLA, F.R.A.S., F.C.S., ETC.

Vice-President of the Entomological Society of London.



LADIES AND GENTLEMEN,

Although our Rules do not make the delivery of an annual address a necessary part of the duties which devolve upon your President, I think that the custom of reviewing the labours of the Club annually is a healthy one, and on the occasion of this our first Anniversary it will not be amiss to express the hope that this custom will be regularly observed by our future Presidents.

In taking stock of the work done during the first year of our existence, we have every reason to congratulate ourselves upon the general success of the Club; and I do not think that I go too far when I state that it is impossible to name any other Society of a similar character which has grown so rapidly within such a small period of time. From the 140 original members entered down to February 28th of last year—the date of the delivery of my inaugural address—we have now risen to about 240 members, and candidates for admission still continue to come forward. It is often observed, however, that when an organism grows too rapidly, a constitutional weakness is the result, and I should be no true friend of the Club if I reviewed our work solely from an optimist point of view; it will be more conducive to our future welfare if I point out what appear to me to be certain weaknesses, so that some of

this growing energy may be directed into the proper channels for strengthening our constitution.

In the first place, we must never lose sight of the fact that we profess to be a local Natural History Society, and although we include the names of some few county naturalists whose scientific *status* is well established, we cannot close our eyes to the fact that we are, generally speaking, in a state of scientific poverty. I dwell upon this point because in starting this Club our first object was to promote local scientific work, and if we fail in doing this we must necessarily undergo degeneration, and our case may be in danger of becoming suggestive of the tragedy of Hamlet with the Prince of Denmark left out. It is true that our meetings have, on the whole, been well—I may say excellently—supported, but it must not be forgotten that our chief help has come from external sources. Our “Proceedings and Transactions,” which are just published, will show that many of our contributions, and our most interesting discussions and exhibitions, have been left dependent on a very limited number of our own members, or have come from outsiders. We must express our thanks to those who have so kindly extended their aid to us; but we must do more if we are to maintain our high position—we must show our appreciation of their support by working ourselves. It is my sincere desire to see the Club stand as an independent edifice, based on a secure foundation, and strengthened, if necessary, by occasional external support, but not left as an altogether shaky structure entirely dependent upon such props.

Our rapid growth bears witness to the fact that our objects and pursuits are of widespread interest, and it must now be our earnest endeavour to convert this passive interest into active co-operation. I again appeal to our younger and rising members to take up the study of some branch of natural science—to make observations bearing on the natural history or geology of our district, and to communicate the results of their labours to the Club. One of the most serious obstacles in the way of natural science studies among those who have had no special training in

such subjects appears to be the belief that some special quality of mind is necessary, and many who are really interested in the pursuits of the naturalist allow their interest to remain passive for this reason. But the necessary qualities of mind really differ in no way in kind from those possessed by any person of average intelligence. Professor Huxley is never tired of insisting that science is but organized common sense:—"Anyone who looks into the matter attentively will soon perceive that there is no solid foundation for the belief that the realm of science is thus shut off from that of common sense, or that the mode of investigation which yields such wonderful results to the scientific investigator is different in kind from that which is employed for the commonest purposes of every day existence. Common sense is science exactly in so far as it fulfils the ideal of common sense—that is, sees facts as they are, or, at any rate, without the distortion of prejudice, and reasons from them in accordance with the dictates of sound judgment. And science is simply common sense at its best; that is, rigidly accurate in observation, and merciless to fallacy in logic."* These statements, coming from one of the masters of biological science, must surely hold out every encouragement to those who desire to take up the study of these subjects. There is no one amongst us but, after he has once acquired a substantial groundwork in some branch of our studies, can do real service to the Club and to science at large, and I only hope that our next volume of publications will show that these remarks have fallen upon fertile soil.

In many scientific societies it is customary for the President to occupy the attention of the members at the annual meeting with a discourse upon some special branch of science with which he is most familiar, and although this is a custom of which I greatly approve, I much regret that my numerous occupations have left me without the time necessary for collecting the materials for such an address.

* "The Crayfish: An Introduction to the Study of Zoology," 1880, pp. 1 and 2.

As this is only our first year, however, it is perhaps better that I should draw more attention to the general work of the Club, in order to show to what extent we have striven to carry out our objects, and how far we have been successful.

As already stated in the Report of the Council, we have held eleven Ordinary Meetings and seven Field Meetings during the year. Although our Ordinary Monthly Meetings have been on the whole well supported, we have thought it desirable to diminish their number this present session, in order to increase our chance of securing good attendances throughout the year, and no Ordinary Meetings will be held during the months of June, July, and August. By this means we hope to concentrate the energy of twelve meetings into nine, and in order to make further sure of keeping alive the interest of our members, the Council has decided that each meeting shall be announced by a special notice, so that members may be made acquainted beforehand with the subjects which authors or exhibitors propose bringing forward. For the carrying out of this plan we are entirely dependent upon our members, and it is earnestly requested that notice will be given to the Secretary of any paper that is to be read, or any exhibition that is to be made, at least ten days previous to the meeting.

Of the numerous subjects brought forward and discussed during the past year, it is not my intention to give a detailed account, as our "Proceedings" containing full reports of the meetings are now in your hands. For maintaining the interest of these meetings, the Club is very much indebted to our indefatigable Honorary Secretary, Mr. William Cole, and to our members Mr. R. M. Christy, Mr. James English, and others. Mr. Henry Walker's interesting lecture on "A Day's Elephant Hunting in Essex" formed the first part of our "Transactions" published in September. Among the discussions raised, one of the most suggestive appears to me to be that which followed the reading of Mr. Christy's note on the habits of the weasel and stoat, at the March meeting, on which occasion I had the pleasure of giving expression to some ideas which I have long entertained with respect to the white colours of

Arctic animals. I hope to have an opportunity of enlarging upon this subject on some future occasion.

Our Field Meetings cannot but have left pleasant memories with us all. In spite of unfavourable weather on many occasions, they have always been well attended, and their success is largely due to the efforts of the eminent gentlemen who have acted as our conductors. The best thanks of the Club are due to Sir Antonio Brady, Professor Boulger, Dr. M. C. Cooke, Major-General Pitt-Rivers, Mr. B. H. Cowper, Mr. D'Oyley, Mr. Worthington Smith, and Mr. Henry Walker; whilst upon our Honorary Secretary has not only devolved the organization of these meetings, but likewise the preparation of those excellent reports which have appeared in the *Woodford Times*, and which we shall many of us peruse with the interest of personal experience as now published in our "Proceedings." Among the most memorable of these excursions was the visit to Ilford in July, under the leadership of Sir Antonio Brady and Mr. Henry Walker, on which occasion most interesting collections of flint implements and other objects of Palæolithic and Neolithic age were exhibited by Sir Antonio Brady and Mr. Worthington Smith; and Mr. A. R. Wallace favoured us with a brief sketch of his views on the great question of geological climate which have recently appeared fully elaborated in his admirable "Island Life." It would be quite out of place to attempt here to lay before you any of the lines of argument adopted by Mr. Wallace in support of his theory, but it will be instructive, as showing the rapidity of the onward march of science, if I just mention one of his main conclusions, in so far as it bears upon a statement made in my inaugural address delivered last February. In speaking of the glacial epoch (*i.e.*, the last glacial period, with its alternations of warm periods), I stated that the causes of these wonderful conditions of climate were of an astronomical nature, thereby of course indicating the occurrence of winter in aphelion (brought about by the precession of the equinoxes) during a period of great excentricity of the earth's orbit. This theory, due to Dr. Croll, has long been held by our most eminent

geologists, but Mr. Wallace has now given weighty reasons for believing that this explanation is inadequate, and that purely astronomical causes are insufficient to account for such great climatic changes. He is of opinion that certain concomitant geographical changes are also necessary, and he thus adds to Croll's astronomical theory a modification of the purely geographical explanation of climatic change long ago advanced by Sir Charles Lyell in the "*Principles of Geology*." The history of science presents many such instances of the amalgamation of hypotheses. A theory may for a long time be maintained until some new and more perfect theory is offered in its place—in the heat of intellectual excitement the older theory is rejected under the belief that the newer one has rendered it unnecessary, but in the course of time it is seen that the two are not necessarily mutually exclusive, and some master worker shows that they are both requisite for an adequate explanation of the phenomena concerned.

The Field Meeting held on the 3rd of July, when Major-General Pitt-Rivers gave us the benefit of his large experience on the occasion of our visit to the ancient earthworks in the Forest, has opened up a line of work which may enable our Club to do substantial service to archæology. At this meeting, in addition to our conductor, we had with us Mr. W. L. Distant, one of the directors of the Anthropological Institute; Mr. B. H. Cowper, the discoverer of the Loughton Camp; and Mr. D'Oyley, the surveyor of the earthworks; to these gentlemen the thanks of the Club are due. The history of these camps is quite unknown, and their supposed founders come down to us only through uncertain traditions which are valueless to the scientific archæologist. At the suggestion of our conductor we therefore determined to attempt to settle the problem, by raising an "Exploration Fund" for the purpose of opening these earthworks, with a view to obtaining some relics of their constructors. I have already had the pleasure of informing you that the necessary permission has been granted by the Forest Conservators, and the thanks of the Club have been rendered to this body, and to our esteemed

member the High Sheriff, Mr. Andrew Johnston, who laid our cause before the Epping Forest Committee of the Corporation of London. The details of the proposed method of excavation have been made known to you on a former occasion, but as there still appears to be some uneasiness in the minds of many of our members as to our possibly doing a permanent injury to these picturesque remains, I will give a few words by way of further explanation. The investigation will be conducted by digging a trench about ten feet wide from inside the camp right through the inner rampart and ditch, and on through the outer rampart to the exterior boundary of the camp. This trench will be carried down to such a depth as to get below the old surface line, and a most searching examination of the soil will be made as it is removed. Any relics found on this old and buried surface will certainly have been left by the original builders of the camp, and every precaution will be taken to insure an accurate record of the exact position of any object that may be found. A plan of the proposed method of working has been kindly drawn up for our use by General Pitt-Rivers, and Mr. W. D'Oyley has offered his valuable services in assisting to carry out the practical details. In accordance with the terms of the permission granted by the Epping Forest Committee, the trench will be filled in, and the original form of the camp restored after the conclusion of our examination, so that our members may rest satisfied in the belief that no permanent disfigurement will result. It may perhaps be thought advisable to erect some mark indicating the position of our cutting, so that if at any future period other investigations of the same camps should be made, the excavators may not run the risk of going over our work again. The Exploration Fund, as you already know, now amounts to about £40, a sufficient sum to enable us to investigate one of the camps, and to publish our results; and if these are sufficiently encouraging, we shall feel justified in appealing for a further sum of £20 or £30 to enable us to open the other camp. A preliminary survey will be made, and operations will be commenced as soon as

the weather gives some prospect of our being able to find the earth dry enough for sifting.

In attempting to unravel the mystery that surrounds these venerable relics of human workmanship, and in endeavouring to discover the true origin of the camp at Ambresbury Banks, and of "Cowper's Camp," we may perhaps be accused of trenching upon the province of our old-established colleagues the Essex Archæological Society, but as this is far from our intention, it will not be here out of place if I venture to define what to me appears to be our position with respect to this Society, and to archæology in general. In point of fact the studies of the Society mentioned commence where ours leave off—it is more especially prehistoric archæology with which I think we should concern ourselves as a Natural History Club; and although we shall always welcome historic archæological contributions from our members—especially when relating to the biographies, &c., of Essex naturalists—I am of opinion that our Treasurer's purse should not be bled in order to publish such papers *in extenso*, but that such materials when communicated to us should be handed over by the Council to our brother Society to be published or dealt with as they shall think fit. Let not these remarks in any way deter our members skilled in archæology from giving us the results of their labours; their contributions will add greatly to the interest of our meetings, and their value to the science will be the rather augmented by their being ultimately referred to a Society which has made these subjects its proper study.

The only other Field Meeting upon which I feel called to make any comment was the last of the session, held on October 2nd, under the leadership of Dr. M. C. Cooke, Mr. Worthington Smith, and Mr. James English. A humorous account of this "Fungus foray" appeared in the *Gardener's Chronicle* of October 9th, from the pen of one of our conductors, and the full list of the most noteworthy species collected appears in our "Proceedings." The meteorological authorities treated us badly on that occasion; but notwithstanding their "aqueous humours" we mustered

strongly, and the Cryptogamic Botany of this country was powerfully represented in the persons of our conductors and visitors, whilst French science did us the honour of recognizing our meeting in the person of the eminent botanist Professor Maxime Cornu, of Paris. So successful was this meeting in the opinion of our leaders that we have determined to make an annual institution of it, and I only hope that for many years to come we may rally around the same able conductors.

The next point to which I propose to direct your attention is the existing state of affairs with reference to our Library and Museum. These are still in a rudimentary condition, but a fair start has been made, and many donations of books, periodicals, and specimens have been received during the year. The prospects of seeing ourselves established in a building of our own appear to be as yet remote, but a timely offer of assistance has come from the proprietors of the Art Classes, to whose kindness we are indebted for the use of the apartments where we now hold our meetings. Two rooms in this house have been allotted to the Club for the Library and Museum, and the Council has resolved that a certain portion of the funds arising from life-subscriptions shall be expended for the legitimate purpose of putting up such fittings as are considered sufficient to meet our present requirements. We are thus in a better position to make an appeal for donations, and I cannot too strongly urge upon our members the necessity for using every effort in their power to assist in the furthering of this object. If it is made generally known that we have accommodation for books and specimens, I have no doubt but that many contributions will be forthcoming; and when we are able to show that a good nucleus exists, scientific writers will be encouraged to place copies of their works on our shelves, where they know that good use will be made of them, or to present us with collections which they desire to keep local, and which they may feel assured will be well looked after.

The various books presented have been announced at our meetings, and the thanks of the Club have been

voted to the respective donors. Among the first contributions of value to the Museum is the Herbarium of mosses and lichens, formed by Richard Warner, presented by Sir J. Clarke Jervoise, Bart. I am also glad to be able to inform you that the Rev. Francis Walker, of Dry Drayton, has recently offered us his ornithological and entomological collections formed in that parish. As the specimens were all collected in the neighbouring county of Cambridgeshire, this generous offer has been accepted, and, in accordance with the wishes of the donor, the collection will be kept separate in our Museum. I trust that at no very distant period it may be the duty of your President to announce that we have outgrown our present accommodation; this will be a sure sign that we have workers in our midst, and an appeal for disestablishment from our present quarters may then be met by substantial support.

In the course of our endeavours to promote science in this neighbourhood, a series of winter lectures has been commenced, the first of which, on Forest Animals, delivered in November by our well-known colleague Mr. J. E. Harting, has been published in full in our "Transactions." The second lecture of the session, delivered at the beginning of this month by Mr. A. R. Wallace, on "The Natural History of Islands," must yet be fresh in your memories. Although this discourse was replete with facts and arguments of the highest importance, and we had the privilege of hearing directly from the mouth of the investigator a most masterly exposition of those subjects which he has made his life-study, we cannot fairly consider it within our power to print this lecture *verbatim*. The subjects treated of by Mr. Wallace will be found in one of the Manchester Science Lectures, and fully elaborated in his "Island Life," to which work I may refer any of our members who require further information; the lecturer's remarks, moreover, covered a field too wide to be considered as legitimately coming within our province as a local Club. We shall hope to continue these lectures from time to time during the present session at least, and as their object is

solely to awaken a general interest for science in our own district, it will be better not to consider our lecturers in any way bound to treat of purely local subjects. As this part of our work is in fact educational, I am of opinion that any branch of natural history (in its widest sense) may justly come within our scope; and, in order to give the greater effect to our operations as scientific missionaries, I would suggest that these lectures, if carried on next session, should take the form of a course on some particular subject.

As a Club founded for the purpose of studying the natural history, &c., of the county, and of Epping Forest in particular, we have every reason to be grateful to the Corporation of London for their successful efforts in preserving the Forest, and I hope I may add, in accordance with the words of the Epping Forest Act, in maintaining as far as possible its "natural aspect." To us, as naturalists, the Forest is only of interest so long as it remains as such. When we consider that we have within easy reach of the Metropolis a magnificent area of wild and picturesque country freely accessible to the public at large, and long the resort of that more limited class who wander through its copses or across its heathy expanses as students of nature, the majority of us must feel that it is our duty to express our disapprobation of any act that would tend to injure directly or indirectly the natural features of that Forest which both in our own interest, and in that of the numerous kindred societies in and around London, we now justly regard as the object of our watchful care. It was on these broad grounds, and quite independent of all questions of private interest, that our Council met on the 8th of this month to consider the proposed extension of the Great Eastern Railway from Chingford to High Beech. Mr. Francis George Heath, one of our members well known to the public for his zealous efforts in connection with the preservation of open spaces, brought under our notice a resolution protesting against this scheme. This resolution was carried by a large majority, and has been published in many of the papers, where

it has doubtless come under your notice. Those of our members who agree in this decision cannot but rejoice that the press generally, as well as many large and influential bodies, have also expressed their disapproval of this interference with the Forest, and for my own part I can only give utterance to the wish that the Railway Company may be led to reconsider their plan, or to alter the route of the projected extension so as to leave our Forest untouched.

The remarks made at the commencement of this address with reference to our lack of active science workers will, I trust, be taken in the spirit in which they were offered—the desire to see the Club doing good work and taking a high position among such societies. We are still in our infancy, and too much ought not to be expected from us at first starting. Still, in view of our increasing energy, it is not too soon to begin to consider some of the numerous lines of useful work which we might take up, and I will therefore in conclusion offer a few suggestions which may possibly serve to hasten the production of some of the more solid contributions to science which it should be our ambition to see emanate from this Club.

In the first place, as regards local catalogues of animals and plants—our County Directory—why should we not commence this next season upon some of the better known orders of insects, such as Lepidoptera or Coleoptera? Supposing we take the former, as having been the more extensively worked at. A large amount of material already exists scattered throughout the various British entomological publications, and we should have to commence our list by systematic compilation. That done, we can begin to collect records from our own members, many of whom have long collected in the county; and I would suggest that a circular should be sent round, not only to our members, but also to all entomologists who may have worked our district, asking for their assistance. In the case of the rarer species, the locality, date of capture, and name of captor should be given, together with references if the capture has already been published. Every care should be taken to make our first list a typical one, and workers at

other groups would thus be encouraged to follow it up by catalogues of their own special objects of study. There is yet another point to be mentioned in connection with the preparation of such lists, and that is the possible occurrence of local variation. Of course we cannot expect in such a limited area to find many or well-marked instances of this phenomenon, but it nevertheless seems to me desirable to make a most careful comparison, especially in the case of variable species, between series from the various portions of our own county and series from other parts of the country and from the Continent. This is the more especially desirable with common and variable species which extend to our marsh-fringed coast. Mr. H. W. Bates tells us that in the Amazon Valley the butterflies undergo modification to such an extent that many species appear to change into a distinct local race in every fresh district. It is obviously useless to look for such striking instances in a small island like ours, where there are but few facilities for isolation, and where local variation is consequently obliterated by free intercrossing. But there is no reason why the phenomena which occur in the tropics *en grand* should not appear in this country *en petit*, and a searching examination of long series of specimens in the manner suggested may possibly result in the discovery of some positive evidence in this direction.

The next suggestion is one that appeals to our botanists. We have had recently added to our Forest large tracts of land formerly under cultivation, but now being gradually reconverted into forest land. It appears to me that we have here a natural experiment going on of which we should take advantage: we can surely learn something of the manner in which a forest spreads by keeping a careful watch upon such tracts, noting the plants that from time to time make their appearance, and by this means recording the encroachment of species, and observing the effects of that struggle for life which is one of the prime factors in the evolution of living forms.

One other suggestion, and I have finished. Now that our sylvan head-quarters have so much increased in extent

and are preserved, I hope, from rough usage, why should we not make an attempt to restore some of the beautiful insects that formerly inhabited our Forest, but which have been collected off the face of the district? Why should not our glades be once more enlivened by the graceful flight of *Limenitis Sybilla*? Why should we not see *Argynnis Paphia* a common frequenter of our bramble-blossoms? Such species abound in New Forest, Hampshire, and the conditions of our own Forest seem favourable for them; they formerly inhabited this district, and there is no reason, as far as we can see, why they should not do so again. Some of our members will, perhaps, bear this suggestion in mind during the approaching summer, and, instead of filling rows in their cabinet drawers, will forward living specimens to enable us to attempt this restoration.

The brief *résumé* of our work which I have now laid before you cannot but impress those who are interested in our progress with the idea that we have entered upon our career with an activity that promises well for our future prosperity. The objects of the Club, as laid down in our Rules, have thus far been carried out with success, and our position as a scientific body is now well established. We are about to enter upon another year of our labours: it is for you to carry on the good work.



JOURNAL OF PROCEEDINGS

AT

ORDINARY, FIELD, AND OTHER MEETINGS.

[In commencing our Journal of Proceedings it may be well to give a brief statement of the origin of the Club. The first public proposal in connection with the subject was made in a letter addressed to the Editor of the *Woodford Times* by Mr. William Cole, which appeared in the issue for Saturday, October 25th, 1879. This letter was followed by others from Messrs. Harcourt, Lockyer, Argent and Cole addressed to various local newspapers, all strongly urging the establishment of a Naturalists' Club in Essex. A circular was issued by Mr. Cole, headed "*Epping Forest and South Essex Naturalists' Field Club*," and freely distributed, asking for the support of all South Essex naturalists and archæologists. Sufficient names having been received to warrant the step, a private meeting was held at Buckhurst Hill on Saturday, November 15th, 1879, to settle preliminaries. Mr. Cole was nominated as Hon. Secretary *pro tem.*, and was authorised to call a public meeting for the establishment of the Society, and to make all necessary arrangements. It was felt that it would be better to have a more comprehensive title than that above quoted, and the one now held by the Club was chosen. Mr. R. Meldola consented to become the first President, and ultimately the inaugural meeting was called by advertisements in the newspapers and the issue of a very large number of circulars, which were sent to the leading inhabitants in all parts of the county. The Editor places the circular letter on record here; it may be interesting in the future as expressing the views of the founders of the Club:—

EPHING FOREST AND COUNTY OF ESSEX NATURALISTS' FIELD CLUB.

Laurel Cottage, Buckhurst Hill, Essex.

Dear Sir,—I am requested to state that the inaugural meeting of this Club will be held on Saturday evening, January 10th, 1880, at the rooms of the Buckhurst Hill Art Classes, 3, St. John's Terrace (opposite the church). The chair will be taken at seven o'clock by R. Meldola, Esq., F.C.S., &c., Secretary to the Entomological Society of London.

The objects of the Club, as set forth in the proposed Rules, are as follows:—"The investigation of the natural history, geology, and archæology of the County of Essex (special attention being given to the fauna, flora, geology, and antiquities of Epping Forest); the publication of the results of such investigations; the formation of a library of works of local interest and other publications, and the

dissemination amongst its members of information on natural science and antiquities." Excursions, under skilful direction, to various localities of interest to the naturalist and antiquary, will also be a main object of the Club.

The Club will strongly discourage the practice of removing rare plants from the localities where they are to be found or of which they are characteristic, and of risking the extermination of rare birds and other animals by wanton persecution; it will also endeavour to use its influence with landowners and others for the protection of the same, and to dispel the prejudices which are leading to their destruction. In like manner the Club will endeavour to cultivate a fuller knowledge of local antiquities, historical, popular, and idiomatic, and to promote a taste for carefully preserving the monuments of the past from wanton injury.

Considering the fine field offered to the biologist in Epping Forest and the surrounding country, it is certainly a matter of surprise that a Society similar to that now in process of formation was not long since founded. At any rate the promoters of the Club venture to claim for it the cordial support of all students of the subjects comprised in the scheme, as well as the approval of those willing to encourage the pleasant, instructive, and healthful recreations of the amateur field naturalist and antiquary.

The proposed subscription will be fifteen shillings per annum for gentlemen and ten shillings for ladies. Persons residing beyond a certain radius (say fifteen miles) from the head-quarters of the Club will only be required to pay subscription of ten shillings and seven shillings respectively. Persons joining the Club upon or within two calendar months from its establishment will thereupon be considered original members.

Should you approve of the objects of the Club, but be unable to attend the meeting, I should be much obliged by your signing the accompanying letter and returning it to me at your earliest convenience. I shall then have much pleasure in adding your name to the list of original members.—I am, yours faithfully,

WM. COLE (*Hon. Sec. pro tem.*)

Several kindly and appreciative notices of the proposed Society appeared in London and provincial journals, and upwards of a hundred ladies and gentlemen enrolled their names as original members before the day fixed for the formation of the Club.]

SATURDAY, JANUARY 10TH, 1880.

A public meeting for the foundation of the Club was held at seven o'clock in the evening in the rooms of the Art Classes, Buckhurst Hill

(kindly placed at the disposal of the Society by the conductors). A large number of people were present, the chair being taken by Mr. R. Meldola, F.R.A.S., F.C.S. (Secretary to the Entomological Society of London). Mr. Meldola said it was unnecessary to make any remarks by way of apology for calling the Club into existence. The proposal had been warmly taken up in many quarters, and the number of ladies and gentlemen present that evening was an evidence that such a Society would be heartily welcomed in the county. Mr. N. F. Robarts, F.G.S., proposed the foundation of the Club, the resolution being seconded by Mr. W. C. Barnes, and carried unanimously. Mr. W. Cole (acting as Secretary *pro tem.*) then read the rules he had drawn up for the approval of the meeting, stating that the same had been carefully settled by Mr. Charles Browne, M.A., Barrister-at-law, who had consented to act as Hon. Counsel to the Club. Each rule was discussed separately, a few alterations being made, the principal one being the reduction of the subscription to half-a-guinea per annum.* Ultimately the rules were passed and ordered to be printed, on the motion of Mr. J. P. Hore seconded by Mr. W. C. Barnes. The meeting then proceeded to elect the Officers of the Club for the year 1880, and the following were chosen:—*President*: Raphael Meldola, F.R.A.S., F.C.S., &c. (Secretary to Entomological Society of London). *Treasurer*: H. J. Barnes, F.C.S. (Berlin). *Secretary*: William Cole, M.E.S. *Librarian*: W. J. Argent. The following gentlemen were selected to form the first Council of twenty-five members:—Dr. E. B. Aveling, F.L.S.; R. L. Barnes, F.C.S.; W. C. Barnes; E. N. Buxton, J.P., &c., Verderer of Epping Forest; J. T. Carrington, F.L.S. (Naturalist to Royal Aquarium, Westminster, and Editor of "Entomologist"); R. M. Christy; P. Copland; E. A. Fitch, F.L.S., M.E.S.; Rev. James Francis, M.A.; G. J. Godwin; Herbert Goss, F.L.S., F.G.S., &c.; J. C. Harcourt; Francis George Heath (Author of "Our Woodland Trees," "The Fern World," &c.); H. B. Hooper; J. P. Hore (Author of "The History of Epping Forest"); Andrew Johnston, J.P. (High Sheriff of Essex, and Verderer of Epping Forest); Alfred Lockyer; Nathl. Powell, J.P., &c.; Hildebrand Ramsden, M.A., F.L.S., F.R.M.S., &c.; Rev. C. J. Ridgeway; N. F. Robarts, F.G.S., &c.; W. G. S. Smith (Hon. Sec. "Epping Forest Fund"); C. E. Taylor; Rev. W. Linton Wilson, M.A.; T. J. Woodrow, F.S.S.

It was proposed by the Rev. C. J. Ridgeway and seconded by the Rev. W. Linton Wilson, that Charles Browne, Esq., M.A.; Charles Darwin, Esq., M.A., LL.D., F.R.S., F.L.S., F.G.S., &c.; Alfred Russel Wallace, Esq., F.L.S., F.Z.S., &c.; and William Whitaker, Esq., B.A., F.G.S., &c. (of Her Majesty's Geological Survey), be elected Honorary

* This alteration was strongly protested against by the founder of the Club, as being adverse to the conclusion he had arrived at after careful consideration of the merits and probabilities of the case, but on being put to the vote the smaller subscription was adopted by the meeting.—Ed.

Members of the Club. This proposal was carried unanimously. The first ordinary meeting of the Club was fixed for the 28th February, and the meeting then broke up, tea and coffee being served in one of the rooms.

SATURDAY, FEBRUARY 28TH, 1880.—ORDINARY MEETING.

The first Ordinary Meeting of the Club was held at the Head-quarters, at seven o'clock, the President, Mr. Meldola, in the chair. Nearly seventy members were present. The minutes of the Foundation Meeting were confirmed.

Letters were read from the gentlemen proposed at the last meeting, returning thanks for their election as Honorary Members of the Society.

In accordance with the power given to him under Rule III., the President nominated Mr. John T. Carrington, F.L.S., M.E.S. (Naturalist, Royal Aquarium), Mr. E. A. Fitch, F.L.S., M.E.S., Mr. N. F. Robarts, F.G.S., and the Rev. W. Linton Wilson, M.A., as Vice-Presidents during his year of office.

The President then delivered an Inaugural Address on the objects and work of the Club. (Transactions, Vol. I., pp. 1-26.)

Mr. John Spiller, F.C.S., said that he was sure all present must appreciate the very admirable address with which they had been favoured by their President. Its preparation must necessarily have taken long study and thought, and he begged to congratulate the members of the Society on having such a masterly plan of operations so eloquently sketched out for their future guidance and encouragement. He hoped that they might look forward not only to a careful record and revision of the facts relating to the natural history of the county, but also to making many substantial additions to the facts themselves. They had certainly enjoyed a great treat that evening in listening to Mr. Meldola's address, but they must not forget that many members of the Club were less happily situated, and had not been able to attend the meeting, and, therefore, in their interests, and in the interests of the Society itself, he begged to propose that the address should be printed and circulated amongst the members. The motion was seconded by Mr. H. J. Barnes, and was carried unanimously.

The Librarian announced that Mr. Whitaker had presented a set of pamphlets, relating to the geology of Essex, to the library, and that Sir Antonio Brady, F.G.S., had sent a copy of a privately printed catalogue of his magnificent collection of the Pleistocene Vertebrata, from the neighbourhood of Ilford, in Essex. Thanks were given to the donors.

The Secretary read a paper communicated to the Club by Mr. R. M. Christy, of Chignal, near Chelmsford, on "The Occurrence of the Great Bustard (*Otis tarda*, L.), and the Rough-legged Buzzard (*Buteo lagopus*).

near Chelmsford, during the winter of 1879." (Transactions, Vol. I., p. 59.)

The specimen of the great bustard was exhibited at the meeting, and Mr. W. Cole stated that the Club was very much indebted to Mr. P. Smoothy's kindness in allowing his valuable bird to be sent from Chelmsford for the information of the members.

Mr. E. A. Fitch, F.L.S., said that he had heard of the two other specimens of the bustard in Essex, this winter; one at Manningtree and one at Maldon. He also observed that the local papers had reported the specimen described by Mr. Christy as occurring at Chelmsford. This was incorrect, as Hull Bridge was ten or twelve miles away from that town.

The thanks of the meeting were given to Mr. Christy for his paper.

It was announced that a "Tea Fund" had been started, to be supported by the voluntary contributions of the members, and in accordance therewith tea and coffee, &c., would in future be served at the ordinary meetings of the Club.

The Secretary stated that the last day for receiving the names of original members was March 10th, after which date members could only be elected by ballot, as provided by Rule VI.

The meeting then resolved itself into a *Conversazione*. Among the specimens exhibited were the following:—Molar tooth of *Elephas primigenius* from brick-earth, Lea Valley, Upper Clapton, and specimens of Granites and Lavas used for road mending by the Woodford Local Board—Mr. N. F. Robarts, F.G.S.; various species of *Fungi* and *Lichens* from Epping Forest, the natural forms and colours being well preserved, and many rare species of *Lepidoptera* taken in the forest during the last thirty or forty years—Mr. James English; drawings showing differences between the Viper and the common Ringed Snake—Mr. Gould; and various living organisms were exhibited under microscopes by Messrs. F. Oxley, F.R.M.S., W. Forster, R. Letchford, F.R.M.S., and Hy. Crouch, F.R.M.S.

SATURDAY, MARCH 20th, 1880.—ORDINARY MEETING.

The Ordinary Monthly Meeting was held at the Head-quarters at seven o'clock, the President in the chair.

Presents of books and pamphlets for the library were announced from the Rev. W. Linton Wilson, Mr. W. Whitaker, and Mr. B. G. Cole, and thanks returned for the same.

Mr. W. Cole exhibited a specimen of *Daphne laureola* (the "Spurge Laurel") recently found in the forest. He had not himself seen the species there before. Mr. English observed that the plant had formerly been quite common in an enclosure near Woodredon Hill, but had been

exterminated by a man who collected it to supply nurserymen for grafting purposes; since that time he had seen specimens in Monk's Wood on two occasions.

The President said that Mr. Woodrow had just placed in his hands a flint implement, the history of which was not known. It appeared to be a very fine specimen of a flint arrow-head.

Mr. T. R. Billups exhibited several rare and interesting species of *Coleoptera* taken in Essex, and referred to in the President's Inaugural Address. Amongst them was *Spercheus emarginatus*, which had become so rare as to be considered extinct. Mr. Billups took many specimens at West Ham during the years 1878-9. The female beetle carries the egg-sac or pouch about until the young larvæ are hatched. Also the very minute but excessively rare *Trichopteryx ambigua* (Matthews). Of this only two specimens were known from Belgium until Mr. Billups discovered it in rotten Hornbeams at Loughton.

Mr. B. G. Cole exhibited a specimen of *Sterrhia sacrariva*, taken in the meadows lying in the valley between Buckhurst Hill and Chigwell, on the afternoon of August 17th, 1879; being the first recorded appearance of the moth in Essex. He also exhibited a very beautiful aberration of *Cynthia cardui* (the "Painted-lady" butterfly) caught in his garden at Buckhurst Hill last summer.

A paper by Mr. John Gibbs, on "An Abnormal Form of *Cardamine pratensis*," was read by the Secretary. (Transactions, Vol. I., p. 64).

Mr. R. M. Christy communicated a note on the habits of the Common Weasel and Stoat. (See Transactions, Vol. I., p. 66).

The President pointed out that the most important point in Mr. Christy's communication appeared to be the statement that an unusually large number of *white* stoats had been seen during the past winter, an observation which, if confirmed by naturalists in other parts of the country, might be found to bear some relationship to the extreme cold which had prevailed at that season.

Mr. Letchford asked whether the severe winter temperature might not have caused the animals to become white by acting directly on the circulatory system in such a manner as to influence the colouring matter of the fur; and he called upon the President to supply more details with reference to his statement that the white colouration might be in some way connected with the Arctic character of the winter of 1879-80.

Mr. W. Cole pointed out that no circulation of fluid could take place in hair or fur, inasmuch as hair was not tubular, but was simply composed of modified and elongated epidermal cells, with pigment diffused throughout.

The President was disposed to believe that the occurrence of an unusually large number of white stoats after a particularly severe winter might be due to reversion. It was well known that all animals and birds inhabiting the Arctic regions had a tendency to be of a white

colour, which was necessary not only for protection of the animals from foes, by causing them to assimilate in colour to the snow which constantly covered their habitats, but also because this colour was best adapted to withstand the severity of an Arctic climate. Mr. Meldola was of opinion that this last cause was of greater influence in giving white coverings to Arctic animals than had hitherto been supposed. It was well known to physicists that white was an extremely bad radiator of heat, so that an animal clad in this colour would lose less heat than if the hair were of any other colour; and by a true process of natural selection white fur, &c., would in this manner become established in the animals of the Arctic regions. It is thus probable that the ancestors of many species now inhabiting temperate regions were white during the Glacial period, a form of colouration which has been retained by Arctic species up to the present time, and which appears by reversion occasionally in species having coloured hair when they are exposed to the same conditions as those which originally gave rise to the white covering. The President stated in conclusion that he brought forward these views as they appeared to him to furnish an explanation of the fact recorded by the author of the paper.

Mr. English said he had received three white specimens of the stoat this winter from High Beach; last year he had four; previously he had not seen one for twenty years. Whether these white specimens were due to severe winters or otherwise he could not say.

Mr. Lockyer asked whether it was possible that the specimens seen were ordinary Albinos? In the latter case, of course, the eyes would be pink.

Mr. English said that in his specimens, as far as he could recollect, the eyes were of the normal colour.

Some observations were made by Mr. Linton Wilson and others on the folly of gamekeepers destroying animals and birds in ignorance of their habits, and the necessity for controlling such destruction in the Forest districts.

Thanks were voted to the authors of the papers.

The Rev. W. Linton Wilson explained the method to be pursued in entering notes in the MS. book he had presented to the Club, and stated that he should always be happy to assist in arranging the materials thus collected.

The President remarked that a mistake appeared to prevail in the minds of many at the last meeting as to the purpose of the "Tea Fund" then started. He explained that to provide tea and light refreshment

* Mr. Christy remarks, under date March 25th, that he has no reason to suppose the specimens mentioned by him were Albinos, and that he never heard of an Albino stoat or weasel. He adds:—"Compared with the North of England, it is quite a rare thing here for the stoat to turn white, but I have just received one from as far south as Sussex that is all white except the top of the head and, of course, the tip of the tail."

for members and friends at the ordinary meetings of the Club, from £7 to £10 would be required per annum. This could not be charged to the working expenses of the Club, and the object of the fund was to provide money for what was deemed a very useful and sociable purpose, by means of voluntary contributions of members and friends.

At the *Conversazione*, Mr. P. F. Copland exhibited a specimen of the Green Woodpecker (*Picus viridis*) from Theydon Mount; Mr. English a specimen of *Conglomerate* found in the woods at Goynes Park, Theydon Garnon; and Mr. Cole a slide showing a portion of the *Trachea* of a larva of *Tipula oleracea*, with a parasitic larva attached thereto; Mr. Cole also exhibited his collection of European butterflies.

MONDAY, MARCH 29TH, 1880.—FIELD MEETING.*

The first Field Meeting of the Club took place on this day. The main body of the members and friends assembled at the Loughton Station in time for the 11 o'clock train from that place to Ongar, and were received by the Secretary. On arrival at Ongar the party at once proceeded to the "King's Head," where luncheon awaited them. Fifty-three members and friends sat down, the chair being occupied by Mr. Meldola. A pleasant walk across the fields then soon brought the party to Greensted, where it was met by Capt. Budworth, of Greensted Hall, and the Rev. R. M. Rodwell. The curious old church of St. Andrew's was inspected, and Capt. Budworth gave a highly interesting address on its history and construction. The body or nave of the church was entirely built of the trunks of trees (probably oaks), split or sawn asunder. The church has undergone a good deal of restoration, and on two separate occasions, the ends of the trunks of the trees composing its fabric becoming decayed, have been sawn off and underpinned with oak. This rude and unpolished building is supposed to have been first erected as a sort of shrine for the reception of the corpse of Edmund, King of the East Angles, on its return to Bury (in Suffolk) from London, whither it had been conveyed to avoid the sacrilege of the Danes, A.D. 1010. A passage in a Latin MS., cited in the *Monasticon*, runs thus: "This body was likewise entertained at Augre, where a wooden chapel erected to his memory remains to this day." The ancient road from London to Bury lay through Oldford, Abridge, Stapleford, Greensted, Dunmow, and Clare. There can be little doubt that the ancient part of Greensted Church was first a temporary shrine or resting place of St. Edmund,

* In these reports of our field meetings the Editor has endeavoured to present chatty and gossiping summaries of the proceedings and adventures at these pleasant reunions, but it must be remembered that the accounts are for friendly and kindly perusal by the members, and are not intended to be rigorously criticised.

and in process of time rendered useful as a parochial church, many additions being made to the fabric. In his lecture Captain Budworth alluded to a curious custom as to the appointment of the rector. The Bishop of London holds the living in trust to present to it the senior curate of St. Botolph, Aldgate, for the time being, provided he is a *single man*, although of course he may marry after the presentation. The Rev. F. Rose, late curate of St., Botolph, had just been appointed, but had not then taken up his residence. In illustration of Captain Budworth's remarks, Mr. Unwin exhibited several views and sections, showing the condition of the church at various periods of its history. A cordial vote of thanks was given to Captain Budworth for his interesting address, and the party pressed forward over the fields, which were fortunately very dry, towards High Laver, Mr. Rodwell kindly placing his carriage at the disposal of some of the ladies.

The somewhat backward season precluded much work in the botanical way; the hedgerows were very bare of herbage, but in places the fragrant Ground-ivy (*Nepeta glechoma*), the "rathe Primrose," and the sweet and modest Violets (*V. odorata et canina*) were commonly seen and gladly welcomed as a sign that the merry days of spring were indeed come. Many specimens of a *white* "variety" of *Viola odorata* were noticed. The pretty and local Moschatel (*Adoxa moschatellina*) was common on many damp hedgerows and under the shade of trees; fine specimens of the Spurge Laurel (*Daphne*) were seen in a small wood near Moretown; young plants of *Hottonia palustris* ("Water-violet") occurred in a pond near Greensted, and *Potentilla fragariastrum* and *Mercurialis perennis* were everywhere in bloom. Mr. E. A. Fitch, F.L.S., pointed out the somewhat uncommon galls of the little Gall-gnat (*Cecidomyia Taxi*) on the yew-trees in Greensted Churchyard.

The only *Lepidopteron* observed was the little "March-dagger Moth" (*Diurnea fagella*), which occurred on trunks of trees in Captain Budworth's park.

Mr. Seward noticed a curious case of almost complete etiolation in the leaves of a rose bush (*Rosa sp.?*).

At High Laver the Club was warmly welcomed by the Rector, the Rev. M. Rodwell, M.A., who explained the various features of interest connected with the church of All Saints, and pointed out some fragments of very old stained glass which had been recovered. The churchyard is celebrated as containing the tomb of John Locke, who died at the seat of Otes in 1704, the quaint Latin epitaph having been written by the philosopher himself. Mr. Rodwell gave some very interesting anecdotes of Locke, and recited two renderings of the epitaph—one, a metrical paraphrase by a friend, and the following prose version from his own pen:—"Stay, passer-by,—Near this place lies John Locke. To your question,—What sort of man was he?—He answers that he was of middle rank and fortune, and was contented therewith: of learned

tastes and habits : he only reached the point of consecrating his learning to the cause of truth above all things. You will discover this from his writings ; and these will more faithfully exhibit to you the rest of his character than the suspected testimonials of an epitaph. Whatever virtues he had, they were not enough to put forward as a matter of glory to him, nor as an example to thee. Let his faults be buried with him. If you seek an example of good life, you have one in the Gospel ; would that there were nowhere any of bad life ; of the shortness of life, you have an example (may it profit thee) both here and everywhere.

" His birth, on August 29th, A.D. 1632 ; his death, October 28th, 1704, is recorded by this tablet, which itself must perish ere long."

The church was thoroughly examined, and afterwards the whole party was most hospitably entertained at tea at the rectory by Mrs. and Mr. Rodwell and spent some time in their pleasant garden. The Club intended visiting Magdalen Laver Church, when the Rev. Mr. Jones, rector, would have explained its points of interest, but time was wanting. In the cool of the evening the members strolled back to Ongar, and sat down to a capital supper tea at the " King's Head." The President made some congratulatory remarks on the success of the first field meeting, and announced that classes for instructing members in the use of the microscope and the study of plants and animals were in contemplation. The Club left Ongar by the 8.15 train, everything having passed off in an extremely satisfactory manner.

SATURDAY, APRIL 24th, 1880.—ORDINARY MEETING.

The Ordinary Monthly Meeting was held at the Head-quarters at seven o'clock, the President in the chair. Nearly fifty members and friends were present. Donations of books and pamphlets were announced from Messrs. Hy. Walker, F.G.S., A. and G. H. Lockyer, H. Goss, F.L.S., and the President. Certificates in favour of eight candidates for election at the next meeting were read.

Mr. W. Cole exhibited a series of specimens of *Ephyra punctaria* for the purpose of showing that the species exhibits in a marked degree the phenomenon of " Seasonal-Dimorphism." There are two broods of the moth in the year, one appearing in May from *pupæ* which have passed the winter in that stage. Eggs laid by the May moths produce another set of individuals in July, which are very different in appearance ; but some of the *pupæ* frequently remain undeveloped, and wintering over, appear in the May following as the ordinary form of the species. Mr. Cole pointed out that this curious fact could be explained on the principle of " reversion," in accordance with Dr. Weismann's theory. The May or " Winter " generation may be viewed as the primitive form which existed in the Glacial epoch : as the summers gained in warmth

another generation became possible in the season, but certain individuals in a brood always exhibit a tendency to revert to the normal habits and form of the species. Mr. Cole also adverted to the fact that the occasional occurrence of such specimens would be of advantage to the species in affording a *cross* between individuals which had developed under very different conditions.

Mr. Robarts and the President made some remarks, the latter pointing out that Mr. Edwards's experiments with *Papilio Ajax* had afforded very similar results.

Mr. Cole also exhibited a series of specimens of *Ennomos angularia*, being the result of an experiment designed to test the influence of food on the colour and markings of insects. No definite influence could be traced to the kind of food on which the caterpillars had fed, although as naturally might be expected, different plants possessed very different nourishing properties. Also a very curious (*Gynandromorphous*) specimen of the pretty silver-studded Blue Butterfly (*Lycena ægon*), the wings on the right side being similar to those of the male insect, whilst those of the left side were of the female type. This specimen was captured at Loughton, in June, 1868.

Mr. English read a note on a new method of preserving plants for the Herbarium, so as to retain much of their natural colours and form. (Trans. Vol. I., p. 71.) The author exhibited specimens in illustration of his remarks, and asked for the assistance and co-operation of members in his endeavours to bring the process to perfection.

Mr. English also exhibited the White Weasels referred to at the last meeting, and a fine specimen of the Long-eared Owl (*Otis vulgaris*) from Magdalen Laver, in the stomach of which he had found the remains of a Song Thrush.

At the *Conversazione*, Mr. C. Oldham showed some fine "cut" specimens of fossil Madrapores, collected by himself on the South Devon coast; Mr. Lindsay, specimens of the minute Primrose (*Primula minutissima*), and *P. rosea* from N. India; and Mr. English specimens of the Wood Anemone (*Anemone nemorosa*) with "double" flowers, and an Albino variety of the Dog-violet (*V. canina*) from Epping; *Chrysosplenium oppositifolium* (Golden Saxifrage) from Ongar Park, and a white variety of the Common Primrose (*P. vulgaris*) from the Forest.

It was announced that at the meeting on May 29th, Mr. Henry Walker, F.G.S., would give a lecture entitled "A Day's Elephant Hunting in Essex," and that a class for the study of practical botany, open to members of the Club, would be commenced, provided the names of a sufficient number of students were received.* Also that a Field Meeting would be held on May 8th or 15th, for the purpose of visiting the ancient earthworks in the Forest.

* Sufficient interest not being shown by the local members in the project, it was subsequently decided not to hold the classes, at any rate just then.—Ed.

SATURDAY, MAY 29th, 1880.—ORDINARY MEETING.

The Ordinary Monthly Meeting was held in the St. John's Church Schoolrooms, kindly placed at the disposal of the Council by the Rector, the Rev. C. J. Ridgeway. The President occupied the chair. Upwards of eighty members and friends were present.

The following were balloted for, and elected members of the Club :—Miss Alcock, Mrs. M. Smith, Messrs. John Finzi, J. M. Gawler, Charles J. Glass, Frank Jesse, Charles Thomas, F.G.S., Charles Welsh. The names of seven new candidates were read.

Mr. Worthington Smith, F.L.S., exhibited six large and heavy Palæolithic implements, found by himself in the Valley of the Lea, near London, and of the same age as the elephants and other animals subsequently mentioned by Mr. Walker in his lecture. These implements are found on both sides of the Lea Valley, generally in sand and gravel, and not unfrequently with bones of *Elephas primigenius*.

Mr. Saward exhibited a remarkably pale form of *Argynnis Euphrosyne* (the "Pearl-bordered Fritillary Butterfly") from Ongar Park Woods.

Mr. E. A. Fitch, F.L.S., brought up for exhibition and distribution amongst the members a large number of specimens of the usually rare Cress, *Lepidium draba*. This plant is a native of the middle and south of Europe, but is not admitted into the British list, being considered by Mr. Watson as an alien; it has occurred in fields and on hedge-banks, at Swansea, St. Peter's, Ramsgate, and in Essex, but always rare, and appearing to be introduced. Mr. Fitch's specimens were from his fields at Maldon. The plant was first noticed twenty or twenty-five years ago, and is now very common. The roots penetrate to a great depth in the soil. Mr. Fitch was of opinion that the seeds of the plant had been introduced with foreign clover seed.

Mr. Henry Walker, F.G.S. (author of "The Glacial Drifts of Muswell Hill and Finchley," "Saturday Afternoon Rambles, Rural and Geological," &c.), then delivered a lecture entitled "A Day's Elephant Hunting in Essex." (Transactions, Vol. I., pp. 27-58.) Mr. Walker illustrated his lecture by reference to numerous maps, plans, and geological sections, some of which were new, and specially prepared for the occasion. He also showed some fine specimen fossils from his own collection. The lecture was listened to with deep attention by the audience, and Mr. Walker was much applauded at its close.

The President said it was almost unnecessary for him to speak of thanks to the lecturer, they had already given their verdict in that hearty burst of applause. The lecture was well worthy of the attention it had received, and he had great pleasure in announcing that the Council had resolved to print Mr. Walker's essay, so that the members

and general public might have an opportunity of studying it at their leisure. Before putting any formal vote to the meeting, he would like to listen to any remarks from members, and he was glad to say that they had amongst them that evening the very Nimrod of Essex Elephant hunters, Sir Antonio Brady himself, to whose noble and persevering exertions science and the nation were indebted for that unique and magnificent collection of *Pleistocene Vertebrata* from the ancient Thames Valley which now rested in the British Museum.

Sir Antonio Brady, F.G.S. (Verderer of Epping Forest), who was warmly greeted, referred, in a long and interesting speech, to the astronomical causes which may be held to account for the various Glacial Epochs, and mentioned in that connection two books which he deemed worthy of special study—Mr. Croll's "Climate and Time," and Colonel Drayson's "Glacial Epochs." To explain the various phenomena observed, we must have recourse to astronomical causes. It appears that the pole of the earth points to the polar star, but that the pole of the plane of the ecliptic is not quite coincident with it, being about 46 seconds from it. It is suggested that the poles do not revolve in space in a circle, but in a slightly eccentric curve. The effect is scarcely noticeable in historical time, but in the course of about 17,000 years such a declension would be caused in the earth's axis with regard to the sun as would in that time bring the arctic circle down to about the latitude of London. This would cause such a change of climate as would account for the Glacial Period, which we know once, if not oftener, obtained in this island, and is especially apparent in the northern part of it, notably in Scotland. In this condition, the sun in our latitude would not rise above the horizon for months together, and the result would be an arctic winter such as now exists in the higher regions of our globe. On the other hand, the sun would be above the horizon for many months together, giving a tropical climate, such as recent discoveries of coal measures and tropical vegetation prove to have existed near the pole in ancient geological times. The effect of the rapid melting of the accumulated winter ice and snow would cause such floods as we have now no experience of, but which would fully account for most of the phenomena of Glacial Drift, and the transport of enormous boulders, presumably ice-borne on the floating icebergs, as we see in a lesser degree at the present time. It is moreover suggested that the animals existing at that time migrated with the changing seasons, some being overwhelmed by the way. The subject was too vast for him to do more in the few remarks permitted him than just to glance at the theories promulgated to account for known phenomena; but anyone wishing for more detailed information on this most intensely interesting subject would be amply repaid by the perusal of the many works which treat on the questions raised, especially those he had already referred to.

One difficulty which always strikes the observer is to account for the number and variety of animals, the bones of which are found in the Uphall Brickfields. The spot appears to have been a perfect graveyard for large animals, both tropical and boreal. Ilford was a cemetery for mammoths, rhinoceroses, *hippopotami*, bison, *et hoc genus omnes*, in the old ice-age, thousands—nay, tens of thousands—of years ago; and a cemetery for Londoners it was at the present day. Sir Antonio believed that the facts could be explained somewhat as follows:—England in the Pleistocene age was not an island, but formed part of the continent of Europe. The Thames was certainly there, and although only a tributary of the great river which drained the vast valley now the North Sea or German Ocean, was a very large and broad stream. The herds of animals whose remains are found buried at Ilford occupied the whole territory so drained. There is reason to believe that the spot where Ilford now is was at that period the centre of a lake-like expansion of the river, bounded on the one side by the Kentish, and on the other by the Hertfordshire, hills. The river was, of course, not then confined, as now, by artificially constructed banks. Bones were often found deposited before the cartilaginous connections had been dissolved, but it was impossible to believe that all those large animals had lived and died in so small a space. Although the remains were not water-worn, they must have been carried to the Ilford brickfield by the same agency that deposited the sand, gravel, and silt around them—namely, *water*. The main stream probably entered the lake-like expansion of the river at or near one corner, and left at another, imparting to the current a somewhat rotary motion, which motion would tend to drift floating bodies towards the centre. The heavier parts of drowned animals, carried along with the stream, would be deposited near to the middle of the lake; and when decomposition set in, the heaviest bones would first become detached from the carcases, fall off, and sink, whilst the lighter ones would be carried further, and some perhaps become ultimately disintegrated and lost. This would explain why so many heavy bones, tusks, teeth, and skulls were seen together. The bones were mostly found in the sands under the brick-earth, soddened with percolating water, by which agency all the animal matter had been washed out, leaving the form of the bone and “skin” (*sic*) perfect, but consisting only of the mineral skeleton, and that in a very soft and pappy state. Their exhumation is therefore a matter of great difficulty, requiring the exercise of much skill. Sir Antonio gave a minute explanation of the ingenious though tedious process employed in exhuming the large and extremely fragile bones from the earthy matrix in which they are found—a process rendered more difficult in the case of large tusks by the *double curve* of those of the mammoth. The last tusk he dug up was over ten feet long. We owed the method employed to the genius and skill of

Mr. Henry Woodward, of the British Museum. The tusk, being saturated with moisture, had first to be underdrained to partially dry it, and to give it a little consistence, or it would not take any of the size or glue which must be employed to replace the cohesive animal matter which in process of time it had lost. The surface having been cleaned from sand and gravel, damp paper was then carefully laid over it, and over this liquid plaster of Paris was poured. This soon hardened, the paper preventing its adhesion to the bone. In the case of a large tusk with a double curve, rods of iron, bent to the shape of the tusk, had to be used, and solidly embedded in the plaster. So far, the upper surface only had been dealt with, and the more difficult or under part had then to be treated. This was done by undermining a few inches at a time alternately, and tying up the underlying matrix (often loose sand) with list or haybands until the entire length had been secured and fixed with plaster. The whole had then to be very carefully turned over on to a platform made to receive it, when more plaster was added, and the bone encased in a perfect splint or case, in which state it might be removed. A large tusk would require from two to three hundredweight of plaster. It was then left to dry, and when ready, the coats of earth, bands, and plaster were carefully removed with saw and chisel; the paper first laid on preventing the adhesion of the plaster to the bone, and preserving the "skin" intact. In drying, the bone cracks all over, and often separates into many hundred pieces. In this case the pieces were numbered whilst still in the plaster matrix, and then boiled in a solution of glue to give them consistency: they were then fitted together again with cement. If these operations were carefully performed, the pieces fitted so accurately that the joints were scarcely discernible.

Sir Antonio referred to his Catalogue of Pleistocene Mammalia from Ilford as being the most complete record ever made of one locality. It was always his desire that his fossils should be preserved in some local museum, so as to be available for study near the scene of their discovery. He had offered them to the East London Museum, but the Government of that day would not accept the trust, and so the collection went to the British Museum, the authorities there having expressed a great desire to have it. There was no Epping Forest Club then in existence, or its resting-place might have been different.

In conclusion, Sir Antonio expressed his pleasure at being present as a member of a society which promised so well, and which had so wide a field of work before it. He moved a cordial vote of thanks to Mr. Walker for his pleasant and instructive lecture.

The President said, before putting the vote, he had a few announcements to make. The projected Field Meeting to the Forest earthworks they were obliged to postpone, owing to the difficulty of securing the services of a skilled archæologist to conduct the same. As soon as

arrangements could be made, the meeting would take place. A Field Meeting would be held on June 5th, in Monk's Wood, with Dr. M. C. Cooke, M.A., &c., as conductor; also one on 19th June in conjunction with the New Cross Microscopical Society. In July Mr. Walker would accompany a Field Meeting to some spot of geological interest; and Professor Boulger, F.L.S., F.G.S., &c., had also offered his valuable services as a botanist. Particulars of these meetings would be announced in the usual way.

The vote of thanks having been carried by acclamation, Mr. Walker said that his best reward was the knowledge that so strong and prosperous a Field Club had been established in Essex. He had had much experience in connection with Field Clubs and Natural History Societies, and therefore spoke with authority in expressing the pleasure he had derived at finding a club so vigorous and determined to succeed, starting on its course of pleasant usefulness.

The usual *Conversazione* took place at the Head-quarters of the Club, 3, St. John's Terraces, where tea and coffee were served. Mr. Wakefield exhibited some beautiful specimens of Agates, Fossil Sponges, Corals, &c., cut and polished; also a fine stone Celt, dredged up from the River Lea, near Waltham Abbey. Mr. W. White, two species of *Stigmaria* from the Coal Measures. Rev. W. Linton Wilson, various specimens of animal and vegetable "Pond Life," including *Lissotriton punctatus* and *Triton cristatus* (Newts), three species of *Lemna* from Chigwell, and many Water-beetles, &c. Messrs. W. and B. G. Cole, a box of insects from Monk's Wood, taken and bred in April and May, 1880. Mr. J. Gibbs, specimens of the abnormal *Cardamine pratensis* described in a paper recently communicated to the Club (*Trans.* Vol. I., p. 64). Mr. English, fine specimens of *Polypterus squamosus*; a hen Blackbird with plumage resembling a Thrush, and other specimens.

SATURDAY, JUNE 5TH, 1880.—FIELD MEETING.

The announcement of a Field Meeting in Monk's Woods, with Dr. M. C. Cooke, M.A., A.L.S., &c., as botanical conductor, attracted a large number of members and friends, nearly eighty ladies and gentlemen assembling at Loughton Station on arrival of the 2.13 p.m. train from Fenchurch Street. The weather, changeable during the morning, had then become more settled, and gave some promise of a fine afternoon. The party was soon in motion, the route chosen being over Staple's Hill, and so at once into the greenwood. There were present Mr. B. H. Cowper, the discoverer, and Mr. W. D'Oyley, the surveyor, of the Loughton "Camp"—a spot which may have been associated with Queen Boadicea, and the final struggle of the

Britons against the Romans. The party was soon encamped within the ramparts of their sylvan fortress, and Mr. Cowper briefly pointed out and explained the leading features and probable intention of this interesting monument of an ancient race. But no lingering could be allowed at the spot, interesting as it is to the lover of history and legend, and the members left it with less regret, inasmuch as they were promised a Field Meeting for the special purpose of examining the Forest earthworks. So "Forward!" was the word of command; and Little and Great Monk's Woods were soon reached. Perhaps no more charming spots than these could be chosen by anyone desiring to see Epping Forest at its best. Monk's Woods are hidden in the midst of the Forest, silent and secluded. The ground surface possesses considerable natural advantages. It is modestly undulating, and in places much broken where some tiny rivulets traverse it, running in picturesque curves through the shady thickets. The trees, unscathed by "lopper" or "topper," at least in recent times, are very types of sylvan vigour, and spread around their graceful boughs with all the wild freedom of Nature. The stroller may here find bits of woodland beauty recalling New Forest itself—giant Beeches guarding vistas of speckled light and shade, with foregrounds of richly branched and tangled Brambles, graceful Bracken ferns, verdant mossed patches, and waving grass and rush. It is a true piece of natural woodland, teeming with objects of wonder and delight for all who have eyes to see, aye, and ears to hear, for the spot abounds in birds and curious forest animals. Many members of the party were soon busy with the flowers and insects, mosses and ferns, which inhabit this delightful spot. There was the Red Rattle (*Pedicularis sylvatica*), a white variety of which occurred not uncommonly; the pretty and changeable Milk-wort (*Polygalia*) in all shades of colour—white, blue, and pink. The Bracken ferns were just unfolding their fronds, and gave fair promise of coming luxuriance. The Needle-whin (*Genista anglica*), one of the prettiest of woodland plants, nestled amongst the Ling in the openings, where the little white flowers of the Heath Galium (*G. saxatile*) contrasted well with the bright yellow blossoms of two species of *Potentilla* (*tormentilla* *et reptans*); whilst in "shadiest covert, hid," the plainer Cow-wheat (*Melampyrum*) bordered the woodland paths. In the streams the bright blue blossoms of the Brook-lime were to be found, and by the brook-side the delicate Yellow Pimpernell (*Lysimachia nemorum*), the variety *flexuosa* of the Hairy Bitter Cress (*Cardamine hirsuta*) and two or three species of *Viola*. The entomologists were not very fortunate; the weather was possibly not favourable for delicate moths—they had betaken themselves to the welcome shelter of the leafy boughs and sedge. However, several species were noticed—the Beech Hook-tip moth (*Drepana unguicula*), and the pretty Geometrid *Ephyra trilinearia*,

both peculiar to large Beech woods. The pond-hunters were busy with rod and bottle fishing up examples of aquatic life from pools and streams. We have no reports of the catches in some cases, but Dr. Cooke has furnished us with the following list of species he met with during the afternoon :—

ALGÆ.

Zygnema cruciatum (Ag.)
Zygnema stagnalis
Spirogyra tenuissima (not
 common)
Spirogyra turpis
Cladophora fracta
 DIATOMS.
Cocconeis lanceolatum
Epithemia turgida
Pinnularia viridis

DESMIDS.

Hyalotheca dissiliens
Closterium Dianæ
Closterium Leiblinii
Closterium rostratum
Closterium gracile (rare)
Spirotænia condensata
Cosmarium cucumis
Cosmarium botrytis
Staurostrum muricatum

He states, however, that he found very little animal life in the collection, except :—

PROTOZOA.

Amœba guttula
Actinophrys sol

ROTIFERS.

Rotifer vulgaris
Metopidia acuminata

(Dr. Cooke adds, " There may be one or two additions to this list, as there are a few specimens which I have not had time to examine sufficiently to fix the names with any certainty.")

About five o'clock the whistle was sounded, and the members found their way in groups to the Wake Arms, where a well-served and substantial tea awaited them. Then, making for the train, the forest road towards Theydon was taken, a halt being made in the woods to listen to the genial conductor, Dr. Cooke, as he discoursed on the wonders of the water, the curious Algæ, Diatoms, Desmids, Rotifers, &c., which a little searching would reveal in the ditches, pools, and swamps of Epping Forest. The rain came down during the Doctor's address, and he made some humorous allusions to the vanity of human wishes as exemplified by the afternoon's proceedings. But he said he had very great faith in Epping Forest as being perhaps the best spot for the naturalist within forty miles of London. As an instance, he mentioned that, on the previous Saturday afternoon, he had found at Snaresbrook three species of Algæ hitherto unknown in Britain—namely,

Hydrianum heteromorphum (Reinsch)
Sphærososma secedens (De Bary)
Closterium linea (Perty).

This result showed that the persevering hunter might still find worlds to conquer in our own districts.

Dr. Cooke's remarks on the various forms of minute life were illustrated by a large series of exquisite coloured drawings made from living specimens under the microscope. But the rain became too persistent; the Doctor shut up his portfolio, and the Club fled along the Theydon Road to the railway, under the shelter of friendly umbrellas. The 8.37 train set down the members of the party at their proper stations; a "good-bye," a rapid hand-wave at the passing carriage-windows, and a pleasant day was gone.

SATURDAY, JUNE 19TH, 1880.—FIELD MEETING.

A Field Meeting of the Club was held in conjunction with the New Cross Microscopical and Natural History Society, the members of the two societies meeting at Theydon Bois on the arrival of the 2.13 train from London. The meeting was conducted by the respective Presidents and Secretaries of the Societies, Messrs. Martin Burgess, R. Meldola, Frederick Stewart, and W. Cole; Mr. Henry Walker, F.G.S., also giving his valuable aid. The weather during the week had been of a very doubtful character, and heavy rain had fallen during the morning. The muster was not so large, therefore, as had been anticipated, but sixty members and friends attended the meeting, and were rewarded with one of the finest afternoons of the season—warm, genial, and bright. The route taken was past Theydon Green and the Church, through the village, and into the woods on the right hand, some distance past Oak Hill enclosure. The forest was at its best; the rain had freshened the plants and trees, but, excepting in the low ground, it was quite dry under foot. Nets, boxes, and vasculums were soon applied to their proper uses. *Orchis maculata* was growing in profusion and perfection; and many were the demonstrations, with a grass stem thrust gently into the spurs of the newly-expanded flowers, of the mode in which insects unconsciously remove the pollen masses on their probosces, and carry the fertilising element to other plants. In a large open of moist heathy land, two species of Hair-moss (*Polytrichum commune* et *P. aloides*) occurred in plenty; and here the remains of poor "Reynard," with his bonnie brush intact, lay festering in the sun! In the woods near this spot, Mr. English found some young plants of the elegant little fern, *Lastrea oreopteris* (*montana*, Newm.) (See Ordinary Meeting, June 26th.) The party then proceeded to a piece of marshy ground on the Cophall Road, where the Bog-moss (*Sphagnum*) grows abundantly. Here the microscopists at once set to work, but with what result only home study could reveal. Two species of a delicate Fungus grew on the moss, and the moisture-loving Bedstraws (*Galium uliginosum* et *palustre*) were

common, with the untidy-looking *Lychnis flos-cuculi*, well named the "Ragged Robin" by village urchins. Then on through the forest towards Ambresbury Banks, noticing the heaps of Bagshot gravel by the roadside, which Mr. Walker explained at one time covered the whole country, and had since been denuded away, with the exception of the outlying patches on the Essex heights, &c. Some little time was spent in examining the Camp, which is supposed to have been the station of the Roman General, Suetonius, when he gained his great victory over the unfortunate Queen of the Iceni. The Britons, headed by Boadicea, perhaps assembled at the Camp at Loughton (visited by the Club on June 5th), were so confident of success that we read they brought their wives and families to view the conflict and enjoy their triumph; and so certain were they of victory that they blocked up the rear of the army with their carriages and waggons. When defeat came these impeded their flight, and a dreadful slaughter ensued; men and women without distinction were slain by the incensed Romans, to the number, it is said, of 80,000 in battle and pursuit. At least, so the story runs in county history and legend.

From this spot the members strolled gently on towards Epping, taking the old hunting glade through the Forest, which has been reopened by the Corporation to form part of their "Green Ride" from Forest Gate to Thorn-wood Common. This part of the Forest is most beautiful, and the fine unlopped beeches were much admired. Many plants were noticed: The Sanicle (*Sanicula Europæa*) and the Pig-nut (*Bunium flexuosum*), the edible tubers of which were tasted with much satisfaction. The lovely *Lotus corniculatus* was in profusion in many parts, and the Honeysuckle and many species of *Rosa* were found wasting their sweetness on the desert air. The entomologists noticed, amongst the *Lepidoptera*, *Halias prasinana*, *Horminea tarsipennalis*, and *nomoralis*, and a very dark female specimen of *Eubolia palumbaria*; many species of *Coleoptera*, *Trichoptera*, *Hymenoptera*, and *Diptera* were also obtained. Mr. W. G. Smith, the well-known Secretary of the Forest Fund, caught sight of a Deer in one of the glades near Ambresbury.

At the Cock Inn, Epping, a very excellent tea was furnished by Mr. Tweed, the comfort of the party being studied in every way. The Rev. W. Linton Wilson, M.A., took the chair, in the temporary absence of the President, and after welcoming the members of the New Cross Society, called upon—

Mr. Walker, who said he had no intention of inflicting a long speech upon them; he always endeavoured in such cases to lean to the side of mercy! They might congratulate themselves on having had a most delightful forest ramble, in company with their good friends from New Cross. It was also a great source of satisfaction to know that they had taken away the reproach from the county, for it was a reproach

for a county like Essex to be without its Field Club. The time had come to show that they were not all bicycle mad; that other things were worthy of attention besides boating and cricket, excellent as these were in their way; and they would offer their protest against the neglect of Nature in these days. They should not stop at that however: they should make their enthusiasm contagious, and seek always to impart the virus to their friends. For himself he could say that he always strove to prove a source of contagion to others. (Laughter.) Mr. Walker made an earnest protest against the wilful destruction of rare plants and animals. He was glad to see that the Rules of the Club emphasized that protest. They felt that the protest was necessary, but they also felt that they had sufficient moral sense to know how to deal with the subject. With respect to their field of study, they had a comparatively unworked ground in almost all branches of Natural History, and in Geology especially. He instanced the *Glacial Morains* which had been recently discovered not far from Epping, with its shells and fossils transported from Lancashire and Yorkshire, and which was an example of the kind of work waiting to be done in the Geology of Essex. In the course of his very interesting address, Mr. Walker also pointed out the benefits to be derived from companionship with men who have made a special study of some one branch of natural science; they must remember that books were always far behind field work, and the great value of the social meetings of Clubs and Societies was that they brought the true student and the learner face to face.

Mr. Martin Burgess, President of the New Cross Society, returned thanks for the cordial welcome accorded to the members of his Society. They had that afternoon seen some of the beauties of Essex, and he hoped it would not be the last occasion on which the two Societies might be able to co-operate in so pleasant and profitable a way.

The company then rambled about Epping until the time of departure by the 8.33 train. This, the third Field Meeting of the Club, was in all respects a successful one.

SATURDAY, JUNE 26TH.—ORDINARY MEETING.

The Monthly Meeting was held at the Head-quarters, at seven o'clock, the President in the chair. The following were elected members of the Club:—Rev. F. A. Walker, B.D., F.L.S., &c., Professor G. S. Boulger, F.L.S., F.G.S., Messrs. W. H. Wright, Ernest Thompson, John Waller, T. Travis, and Wm. Bodle. The names of eight new candidates for election at the next meeting were read.

The President announced that a Field Meeting would be held on Saturday, July 3rd, for the purpose of visiting the ancient camps in the Forest. Major-General Pitt-Rivers, F.R.S. (Vice-President of the Anthropological Institute), would act as Archæological conductor, assisted by Mr. B. H. Cowper, the discoverer, and Mr. Wm. D'Oyley, the surveyor of the Loughton Camp. Professor Boulger, F.L.S., F.G.S., &c., would superintend the botanical researches of members, and many other well-known men were expected to be present.

Mr. James English exhibited the following insects taken in Epping Forest:—*Notodonta dictæoides*, *Stauropus fagi* (the "Lobster Moth"), and curious varieties of *Eubolia palumbaria* (captured at the last Field Meeting), *Argynnis selene* ("Small Pearl-bordered Fritillary" butterfly), and *Lomaspilis marginata*. Mr. English also referred to his re-discovery of the "Mountain Buckler Fern," *Lastrea oreopteris* (*montana* of Newman's British Ferns), at the Field Meeting on the 19th of June. The plant used to occur near Fair Mead Bottom at the back of the "Royal Oak," High Beach, and one or two other localities, years ago. He had often searched of late to re-discover the species, but in vain, until the occasion referred to; he had since noticed another plant. Mr. Cole remarked on the probability of many lost species re-occurring; and instanced the Lily of the Valley, which had become very rare in the Forest. This year young plants were springing up in numbers in several spots.

Mr. Meldola exhibited *Aplecta occulta* (dark aberration), *Aplecta tinctoria* and *Noctua glareosa*, all captured in the woods near Woodford some years ago. Mr. English remarked that *glareosa* occurred occasionally in some parts of the Forest, but that *A. occulta* was a great rarity. Mr. Doubleday had once bred a batch of thirty or forty specimens, but all of the grey tint common in southern specimens, whereas Mr. Meldola's example was similar to the dark northern form of the moth.

Mr. B. G. Cole exhibited the following moths:—*Cucullia chamomilla*, taken at Buckhurst Hill in May; *Tephrosia consonaria* and *Nola cristalis*, taken in Monk's Woods in May; and a series of *Demas coryli* (the "Nut-tree Tussock" moth) bred from *larvæ* found in the same place in September and October, 1879.

The Secretary exhibited some living plants of the "Sundew" (*Drosera rotundifolia*), gathered that morning in Epping Forest. He called attention to the very restricted habitat of the species, and the certainty that any extensive drainage of the locality would inevitably exterminate this, one of the most wonderful of British plants.

The President gave some interesting details of the results of modern study of the "Sundews." He briefly described the structure of the leaves of the *Drosera*, the gland-bearing tentacles, and the viscid fluid secreted by them. Insects alight on the leaves, probably attracted by some odour exhaled by the plant. The viscid fluid covering the ten-

tacles holds the insects prisoners, and in a short time the longer marginal tentacles bend over and with merciless grasp crush the poor captives down to death. The secretion from the glands increases in quantity, and acts, as Mr. Darwin's patient experiments have shown, with a veritable digestive action on the softer tissues of the insects. The nutritive nitrogenous substances are thus dissolved and taken up by the glands, which possess the power of absorption as well as that of secretion. The leaves again unfold, the secretion dries up for a time, the indigestible hard parts of the insects are blown away by the wind, and the leaves are again in a condition to resume their predatory functions. Sometimes large insects are caught in this way, and Mr. Cole mentioned that he had on two occasions seen *Satyrus janira* (the "Meadow-brown" butterfly), an insect measuring nearly two inches across the wings, thus held fast. The vigorous growth of the plant is evidently dependent on the supply of nitrogenous substances obtained by the solution and digestion of its insect prey. Its natural habitat on the surface of a thick layer of *Sphagnum* moss can give the plant little beyond a plentiful supply of moisture, whilst the smallness of the roots, which merely serve to anchor it to its mossy bed, proves that it derives but little benefit from the soil. The predacious habits of the plant are therefore probably of great importance to its well-being. Mr. Letchford mentioned the fact that gardeners find the *Droseracea* very difficult to cultivate; in confinement they probably miss their weekly rations of flies and gnats.

An interesting discussion followed Mr. Meldola's observations, in which Messrs. Letchford, Robarts, Lockyer, the Secretary, and President took part. The habits of carnivorous plants, the functions of Chlorophyll (in which the *Drosera* is very deficient), and the supposed distinctions between plants and animals, were touched upon.

Communications from Mr. R. M. Christy, on "A curious mass of mud found in a thrush's nest at Audley End Park, by Mr. Travis, and supposed to be the work of a *Nuthatch*;" on the question, "How do Wild Ducks, Moorhens, and other such birds introduce their young to the water when their nests are placed on a tree?" and on "Diseased Trout in Essex," were read. (Trans., Vol. I., pp. 66-71.)

Remarks on these subjects were made by the President, Messrs. W. C. Barnes, Letchford, Robarts, English, and the Rev. C. J. Ridgeway, and thanks voted to the author.

Mr. Lockyer read the rules he had drawn up for the Exchange Scheme which had been sanctioned by the Council, and which he would superintend (particulars can be obtained by applying to Mr. Alfred Lockyer, Tavistock Road, Snaresbrook).

At the Conversazione Messrs. English and W. Cole exhibited various plants from the Forest in flower, including *Orchis maculata* (the "Spotted Orchis"), *Habenaria bifolia* ("Butterfly Orchis"), *Listera ovata* ("Tway-

blade"), *Erica tetralix* ("Bell-heath"), *Pendicularis sylvatica* ("Red-rattle"), &c., &c.; and Mr. English several species of *Fungi*, including *Polyporus sulphureus*, *Marasmius urens* (poisonous), &c.; also an example of the rare sub-genus *Eccilia* of *Argaricus* gathered at the last Field Meeting and preserved by his well known process.

SATURDAY, JULY 3RD, 1880.—FIELD MEETING.

"A Field Meeting will be held on Saturday, July 3rd, 1880, for the purpose of a thorough investigation of the Ancient Earthworks of Ambresbury Banks and at Loughton." So ran the circular, which, sent to all members of our Club, had induced nearly fifty enthusiasts to brave the perils of the storm, and take the 2.13 train from Fenchurch Street to Theydon Bois. As the train paused at the several stations to take up some courageous and resolute members, and to set down some timorous and vacillating ones, the greetings and opinions on the weather exchanged from the carriage windows were the reverse of assuring—the rain was simply pouring down, and the sky burdened with dense masses of cloud and vapour sufficient to strike terror into the heart of the most hardened forester. Sometimes, however, fortune favours the brave. At Theydon Bois the rain soon ceased, the sun shone out brightly, and some hopeful ones even predicted a fine afternoon. Alas! again had we to lament, with Dr. Cooke, the "vanity of human wishes"—but more of the weather anon.

In spite of untoward circumstances our party was a goodly one. Our learned archæological conductor, Major-General Pitt-Rivers, F.R.S., Vice-President of the Anthropological Institute (better known, to those who have examined his magnificent anthropological collections lately shown at the Bethnal Green Museum, by his former cognomen, Colonel Lane Fox), and his colleague, Mr. W. L. Distant, Director of the same Institute, were present. Also Mr. B. H. Cowper, so well-known from his discovery of the Loughton Camp and his various papers thereon. Professor Boulger, F.L.S., F.G.S., represented the claims of botanical science; and last, but not least, our good friend Mr. Walker, F.G.S., gave us the benefit of his company and kindly aid. Of course our President was at his post; and no less than eight of our lady members and friends donned "waterproofs" and umbrellas, boldly facing the fortunes of the day. Captain Alex. McKenzie (Superintendent of the Forest) courteously placed the services of the head-keeper, Mr. Luffman, at our disposal, and a start was soon made through the woods to Ambresbury Banks; Mr. W. C. Barnes and Mr. J. Eliot Howard, F.R.S., kindly giving carriage accommodation to some of the party. The Forest was in places very wet, and it required

some amount of skill and agility to safely cross the numerous quagmires which now and again sought to bar our progress; whilst every incautious tap at the trees or bushes showered down glistening rain drops upon devoted heads. At Ambresbury we were joined by Mr. D'Oyley (the Hon. Surveyor to the Club), who brought with him some beautifully drawn plans of the two Camps made from his own surveys.

The archaeologists at once set to work to verify the details of the Earthworks, and Mr. B. H. Cowper gave an interesting sketch of their broad features, and the circumstances under which he first made their acquaintance, seven or eight years ago. He referred to the name Ambresbury (or "Amesbury," as it is pronounced by the country people), as being identical with that of the well-known town in Wiltshire, near Stonehenge, and the celebrated Vespasian's Camp. The word Ambresbury is thought by some to be derived from Ambrosius Aurelius, a foe of the Saxons. If this derivation is allowed to be correct, we may associate the Epping Camp with the most romantic stories of our history, and may conjure up visions of Vortigern and Merlin, and Tennysonian legends of King Arthur and the Knights of the Round Table. But descending to mere matters of fact, he said it was curious that so far as he knew no relics had been found in either the Epping or Loughton Camps; he had often examined them carefully, but could discover nothing in the way of a coin or medal, or other object that would interest the simple antiquary, and enable the true date of the Camps to be fixed. During the examination, General Pitt-Rivers remarked upon the amount of denudation which had evidently taken place from the ramparts, and the large quantity of vegetable and other soil which had accumulated on the ancient level of the Camp. In order to have even a remote chance of finding coins, pottery, or other relics of their founders, it would be necessary to get at the former base of the Earthworks by a careful excavation.

At Mr. Meldola's suggestion, all discussion as to the nature of the remains was deferred until after tea, and a move was soon made to the Loughton Camp, which was first made known by the researches of Mr. Cowper in the year 1872. Owing to the dampness of the herbage our party was obliged to keep much to the main road, and we so lost the ramble through Monk's Woods, which had been looked forward to as one of the pleasantest features in our programme. Professor Boulger's office as botanical adviser was almost a sinecure. Little opportunity was afforded to the phytological enquirer, and the plants observed hardly call for particular notice; but few could fail to be struck with the beauty and profusion of the Orchids in the forest openings. Insects of course were very scarce; with a weather wisdom superior to our own, they refused to creep out from the shelter of their leafy bowers. "Cowper's Camp" was examined by our archaeologists amid the growlings of the coming storm. Viewed from where we stood on the

high ground to the South of the Camp, very grand and impressive were the atmospheric effects exhibited in the valley stretching below us to the Kentish Hills on the other side of the Thames. But even our enthusiasm was soon put to too severe a test, and as the flashes of lightning increased in number and lurid brilliancy, and the rumbling thunder of the ever approaching storm became louder and louder, a general stampede took place. In parties, some in carriages and some on foot, we made for our promised haven, the "Forest Hotel," at Chingford. Some of the number took refuge at the "Robin Hood," and secured conveyance from thence. Mr. Barnes and Mr. Distant *felt* the effects of one of the electrical discharges as their carriage ran along the Lower Road. However, all were eventually safely lodged in the Hotel, and enjoyed the excellent "high tea" provided for us by the manager, Mr. Jesse. After tea, a move was made to the fine room known as the Banqueting Hall, where the President expressed the pleasure he felt at seeing so large a meeting assembled in spite of the adverse meteorological conditions. It was a very gratifying indication of the vitality of the Club. He remarked that the early archæology of Essex came legitimately within their scope; and at a very early stage of the Club's existence he felt that it would be very desirable for it, as a scientific body, to take up this question of the Forest Earthworks, with the view of settling, or attempting to settle, their date. He congratulated the Club on its having been able to secure the co-operation of their eminent conductor, one of the highest authorities in the kingdom on subjects of that nature, upon whom he would call to favour the meeting with the benefit of his opinion.

General Pitt-Rivers said that Mr. Meldola had spoken in very flattering terms of his (the General's) qualifications for the post he had the honour to occupy that afternoon. He confessed he was somewhat taken aback at seeing himself announced as conductor of the meeting, inasmuch as although he had been engaged for many years in studying ancient camps in many parts of the kingdom, he had not before had the pleasure of viewing these remains in Epping Forest. However, they had had the benefit of the best local knowledge as represented in Mr. Cowper, and the assistance of the very excellent tracings prepared by Mr. D'Oyley; these plans formed a great step in advance toward obtaining a knowledge of the remains. In fact he felt that his office as conductor was not a case of the blind leading the blind, but rather an instance of the blind attempting to lead those who could see. He believed there could be no question that both the remains they had visited that afternoon were veritable Camps, such as were found in other parts of the country. He did not himself think there was any evidence for supposing that either of them were Roman. They might be of the Roman age, or possibly of more recent date—Saxon or Danish, or even later in time. Roman Camps are generally rec-

tangular, and at one period he thought that some *data* might be gained as to the origin of a Camp from an inspection of a tracing of its outlines. Further experience had dissipated that idea, and without actual exploration it was impossible to decide on the date of the formation of any of these remains. There are certain Camps which from their outline may be pronounced Roman, and others which may with safety be set down as Norman; but as the general principles of defence have always been the same, it is not safe in the absence of relics to judge from the external appearance of Camps like these, which have no special peculiarities.

The result of their day's work was therefore mainly negative; but the course to be taken in order to settle the question was very clear. They must cut sections through the Ramparts, so as to reach the original basement soil on which the Camps were raised. In his experience he had never known an instance in which this plan had been followed where something had not turned up sufficient to settle the date of the Camp. When you come to the surface line, whatever you find upon that (fragments of pottery, and such things as a knife, spear-head, or a coin) must be of the date of the Camp's erection, or earlier. He would merely make the suggestion that as the Club had been started for the purpose, amongst others, of investigating the Forest, it might be a good way of commencing their proceedings to make such an examination of the Camps. He did not think it need be a very great undertaking, and he thought they would find it satisfactory. At any rate it was the only possible way of settling the interesting problems raised by the existence of these Earthworks.

Mr. Distant considered that the interest which was attached to these Camps, though a purely archæological one, still appertained to anthropology. For if, as Professor Huxley had remarked, "Biology included man and all his works," so much the more did Anthropology. The necessity was by the scientific method of excavation to prove whether these Earthworks were Pre-Roman, Roman, or Post-Roman. This was the kind of work that could and should be done by local Societies, and if undertaken by this Club would act as an example to other provincial associations.

Mr. B. H. Cowper, in an eloquent speech, said that after mature consideration he quite agreed with the views of General Pitt-Rivers, and admitted that the subject was not so simple as he had at first imagined. On the whole, assuming a foundation for the association of Queen Boadicea's name with the locality, he inclined to the opinion that these Camps were the work of the later British, just about the date of St. Paul's preaching. He referred to the accounts of Tacitus and other ancient historians which give colour to the idea that the last struggle of the British took place in Epping Forest. He hoped the Society would take steps to make the proposed explorations of these

ancient landmarks of our forefathers at an early date. There were hardly any monuments of greater antiquity than these in England, certainly not in the neighbourhood of London, and the results of the enquiry would be viewed with interest by all thoughtful students of science and of man.

Mr. D'Oyley made some reference to the first discovery of the Loughton Camp, and Mr. Frederick Young (President of the "Forest Fund") said that it was clear they had only touched the margin of a most interesting subject, and urged upon the Society the necessity of investigating in a thoroughly scientific spirit these curious records of a nation long passed away.

Mr. Fisher Unwin pointed out that these forest Camps were probably not the only remains of the kind in their district, and he thought that the subject of these Camps should be considered as a whole. He mentioned the large Camp or earthwork near the High road between Ilford and Barking. He also referred to the Camp-like appearance of a field on the High road between Chigwell and Abridge, a little beyond Woolston Hall, which had also been pointed out to him by Mr. Cole. He understood that Roman pottery had been found there some years since. The various earthworks in the district were probably related the one to the other.

The President said that the results of their afternoon's work appeared to him to be the following:—There were two Camps in the Forest of ancient date—both undoubtedly the work of man—but their precise period could only be determined by an excavation such as that suggested by General Pitt-Rivers. He hoped that the Club, with the permission of the Forest Conservators, might be enabled to settle this highly interesting local archæological question.* He then called upon the meeting to pass a cordial vote of thanks to their eminent conductor, and to those gentlemen who had so kindly given their services to the Society. This was passed by acclamation, and the company soon afterwards separated.

SATURDAY, JULY 24TH, 1880.—FIELD MEETING.

A Visit to Ilford.

Ilford is by no means wanting in interest to the intelligent visitor; it has a history of which some records happily still persist, in defiance of modern "improvements." A short distance out of the village (or town) may be seen the remains of a Camp which is generally held to be of Roman origin; and it is certain that the Roman road to Colchester

*See Ordinary Meeting, October 30th, 1880.

ran through Ilford about 200 yards south of the present High Road. In the village are eight houses and a chapel, formerly part of a Hospital dedicated to St. Mary and St. Thomas of Canterbury, now used as Almshouses for poor persons, and supposed to have been founded by Adeliza, Abbess of Barking, in the reign of King Stephen, as a retreat for lepers. Of course there is a trace of one of Queen Elizabeth's hunting lodges; ignoble, indeed, must be the locality in the Forest district which does not claim some remembrance of the Imperial (and imperious) Diana. From the Naturalist's point of view the lanes, ditches, and marshes about Ilford are not without attractions, although the impious and devastating hands of the speculative builder are active at their evil work: "destroying beauties that took centuries to make and not a month to mar." But on this charming Saturday afternoon, we (that is some fifty or sixty members and friends of "Our Club") have not met to lament the blows dealt by a money-loving and land-jobbing generation at the fair face of Nature, nor to talk scandal about Queen Elizabeth—we seek records of a past compared with which human histories and legends are but tales of yesterday, and look for antiquities treasured up in the womb of earth, æons before Auctioneers were dreamt of as the coming Iconoclasts! And long will Ilford claim a place in the remembrance of those true antiquaries, the Geologist and Palæontologist; not from its perishing tokens of Roman Legions, fair Queens, fat Abbots, or prim Nuns, but from its rich store of fossil bones: relics of the gigantic animals which lived and died in Britain during the ages limiting that wonderful phase in its life-history, called Pleistocene in modern Earth-lore. The story of the discovery of these records of old-world life at Ilford dates back for nearly seventy years. In 1812, about 300 yards from the River Roding, in a field forming part of an estate called "Clements," some bones of Oxen, horns of Stags, and head bones and teeth of Elephants were disinterred; and in or about 1824, Mr. Gibson, of Stratford, obtained a collection from near the same spot, portions of which are now supposed to be in the Museum of the College of Surgeons. One of our party, Mr. J. Eliot Howard, F.R.S., informed the Editor that he well remembered, when a boy, some of Mr. Gibson's specimens being brought into his father's office at Stratford, and seeing them undergo the process of anointing with a solution of glue to prevent them crumbling into pieces. Then, years afterwards, Sir Antonio Brady took up the quest; with what success let his magnificent collection of Pleistocene Mammalia serve as an imperishable memorial. We have the honour and great advantage of his company this afternoon as one of our conductors, his coadjutor being Mr. Henry Walker, F.G.S., so well known to members of the Club. Our party also includes Mr. A. R. Wallace, F.L.S., the celebrated traveller, philosophical naturalist, and geologist; Mr. Worthington Smith, F.L.S., of

fungological and palæolithic fame; the Rev. Nicholas Brady, M.A., and many distinguished members of the Society, lay and clerical, including our indefatigable President.

We start in good order from the court-yard of the station, and taking the lane on the right leading to Barking, we soon reach the Uphall Brickfield on the banks of the Roding. By the kind orders of Mr. Rawkins, the proprietor of the field, some workmen have been engaged all the morning in clearing one of the pits, and making fresh excavations. We stand with them in the old river bed, watching the turning up of myriads of minute river shells which testify to the fluviatile character of the sand and gravel in which they are embedded. Soon the announcement of a "find" increases the interest; a row of very large and bright molar teeth are first seen, and gradually the lower jaw of the great fossil Ox (*Bos primigenius*) is unearthed in almost perfect condition. It lay embedded in the soil some ten feet from the surface. Some smaller bones are also obtained, and plenty of the shells of *Cyrena fluminalis* which are so characteristic of these deposits. With his accustomed kindness Sir Antonio obtains from the workmen some bones of Mammoth and presents them to the ladies of our party as a memento of their visit to his hunting fields—now, alas! quickly vanishing away and doomed soon to be flooded over with the surging tide of Ilford building operations. Sir Antonio tells us that it was from this, and the adjoining pits a few furlongs south, that he obtained, during thirty-five years' careful research, most of the specimens in his collection; viz., remains of at least 100 British Elephants, as well as bones and teeth of Hippopotamus, Rhinoceros, Bison, and many other animals. A list of some of the species found in the pits at Ilford had been printed on the circular of the meeting, together with two sections showing the geology of the district, kindly lent for the occasion by Mr. Searles V. Wood, F.G.S., and the Editor of the "Geological Magazine."* In response to the President's request Mr. Walker then gives us an account of the former physical geography of this interesting spot, as throwing light on the presence and former existence, in a wild state, of such strange animals in this country. Mr. Walker illustrates his remarks with a series of most instructive maps, showing the different geographical phases which Britain has presented in pre-historic times, when these animals lived. The first map gives a view of Britain rising from the waters of the Glacial Sea, presenting the appearance of an icy archipelago, the higher hills and mountains only being above the waters. The second map exhibits our island not only completely emerged from the sea, but the German Ocean and English Channel laid dry, so that the animals of the European Continent could travel over from the east and the south, even from

* See Mr. Walker's Lecture; Trans., Vol I., pp. 32 and 38.

Africa, into the rich valleys of the Thames country. And this they actually did, the Mammoth and Rhinoceros coming from the east, and the Hippopotamus and Southern Elephant from the south, there being then no Straits of Gibraltar to bar their migration. Whole herds of the great Pachyderms and Deer, which once lived in the wooded wilds of Essex, had died and left no trace of their existence, their bones being devoured by the Hyænas, or gradually dissolved by exposure and decay; but the carcasses of others had been swept into the rivers, where—entombed in the sand and mud—they were safely preserved for thousands of years; and now to-day, when these ancient rivers have disappeared, and we dig down into their sandy beds as we do this afternoon at Ilford, we find these wonderful remains commemorating a vanished past. Another map shows where may be found the physical memorials of the Mammoth period in Essex—the Moraines of the Essex glaciers, as they may be seen to-day up the hills at Epping, Theydon Bois, Havering, &c. Referring to the Great Glacial Submergence and its traces in Essex, the speaker quotes the important investigations of Mr. Searles Wood, who, he assures us, has found on the Essex hills the old beach line of the Glacial Sea at the time the chalky fossiliferous Boulder Clay at Epping, and elsewhere, was deposited. At that time the sea occupied the Thames Valley up to about the level of 150 feet at the part opposite the Roding Valley, and about 180 feet at Cheshunt. To the east of this the level falls, but to the west it rises, so that at Stewkley, in Oxfordshire, it is nearly 400 feet, at Birmingham 500 feet, and so on further west until in Wales a submergence of more than 1,600 feet is reached.

Mr. Walker's remarks are listened to with great interest by us all, standing around him in the pit, not to speak of the crowd of village urchins, and the groups of more attentive navvies, who (neglectful of their Saturday half-holiday) lean on shovel and pick, with their wives and daughters from neighbouring cottages, to "hear tell" of the fashion of the earth they delve in, and how

" Britain *last*, at Heaven's command,
Arose from out the azure main."

He concludes by a kind of apology to those who may hail from more romantic scenery in England—from Derbyshire and Devonshire—for the very unpicturesque country about Ilford, but humorously vindicates the equality of the flat river gravel district of the Thames, in point of palæontological value and interest and geological romance, with the country of Hyæna dens and limestone caves.

We then break out into the London Road to visit the pits in the field formerly known as Curtis's, but now owned by a Mr. Judson. As we stand on the precipice of untouched earth, and look down into the

excavated valleys below, Sir Antonio points out the spots where were found the Lion, the Elephants' tusks *eleven feet in length*, and other prizes of his collection. We ask whether he thinks there is any game left for future hunters; he points to our feet, and hints that there may be as good bones in the bank as ever came out of it. Meanwhile some of our number endeavour to enjoy the pleasures of the chase; not, however, with the flint implements of their palæolithic progenitors, or even the shovels and picks of our friends the navvies, but with a far more potent weapon in these degenerate days—the almighty dollar. With such arms, Mr. Walker secured an excellent molar tooth of a Mammoth with twenty-two dental plates, as well as a tooth of a Calf Mammoth. One workman had a large collection of bones, including a magnificent pair of horns of *Bos primigenius*, but the price—£2 10s.—rather scared even the boldest of our huntsmen.

A move was soon made to the Angel Inn, an afternoon's Elephant hunting by no means lessening our appreciation of the good and substantial meal provided for us by Mr. Ashmole.

After tea the Ordinary Meeting of the Club was held. The minutes of the last meeting were read and confirmed, and the following persons balloted for and elected members:—Messrs. R. J. Friswell, F.C.S., F.I.C., Ernest Heathfield, C. E. Prince, W. Mackonochie, W. E. Martin, Luther Reeves, R. M. Bird Thompson, and G. J. Thompson. The names of fifteen new candidates for membership were read.

The Secretary exhibited, on behalf of Mr. R. M. Christy, some plants of *Galium aparine* sub-species *Vaillantii*, gathered in fields near Saffron Walden, where it was discovered by Mr. Gibson many years ago. This form of a very common plant is especially interesting from the fact that it does not occur elsewhere in England.

Mr. F. Parker exhibited a number of bones obtained at various times at Ilford, including a large hip-bone of Mammoth, a vertebra of Irish Elk, and many bones of *Bos*.

The President said that he wished to make a proposal in connection with their last Field Meeting. It would be in the recollection of those who were present on that occasion that General Pitt-Rivers, and the other archæologists who had examined the ancient Camps in Epping Forest, had come to the conclusion that these were not Roman, but that it would be impossible to fix their period without carrying on excavations. The President stated that he had now much pleasure in informing the Club that since that meeting referred to, General Pitt-Rivers had suggested that an excavation fund should be started for this purpose; that the General had offered to head the list with £5, and he was of opinion that the necessary operations could be completed for about £30 for each Camp. Mr. Meldola said that in his opinion this archæological problem was one which the Club ought to take up,

but it would be of course necessary in the first place to obtain permission from the Forest Conservators. He would therefore propose that the matter should be put in hand at once, and that an official letter on the part of the Club should be addressed to the Epping Forest Committee, after which—supposing, as he was led to anticipate, that the required permission should be granted—circulars should be sent round to all the members in order to raise the requisite funds.

This proposal was received with acclamation.

The President then entered upon the results of the afternoon's excursion. He stated that the Ilford Pits which they had visited were of world-wide celebrity in the annals of Post-Glacial Geology. The brick-earth, gravel, &c., of which sections were there exposed, were deposited at a time when the old Thames was a gigantic stream, and when the Mammoth and other great mammals were denizens of this country. It added greatly to the interest of the remains from these pits to know that the animals of that period were contemporaneous with Palæolithic man. The past had there "buried its dead," but the past was not a "dead past." Their worthy and esteemed member, Sir Antonio Brady, had acted the part of resurrectionist, and by a skilful process of "body-snatching," described in full at one of their previous meetings, had succeeded in exhuming and preserving these great mammals for the instruction of modern and future geologists. In addition to their conductors, Sir Antonio Brady and Mr. Henry Walker, the President said that they were honoured that afternoon by the presence of a Naturalist of European reputation, his friend Mr. Alfred R. Wallace; and they also had amongst them Mr. Worthington Smith, who had recently acquired celebrity as a discoverer of Palæolithic implements. He had much pleasure in calling upon their esteemed conductors and the eminent naturalists he had named to favour the meeting with their remarks.

Sir Antonio Brady, whose name was received with much enthusiasm, said that, although suffering from a severe cold which had prevented him from making any extended remarks at the pit, it gave him much pleasure to be present, and have an opportunity of listening to the observations of some of the gentlemen he saw around him. Sir Antonio brought up with him specimens of stone implements and carved bones from his extensive collection, which he considered to be of special value and interest in reference to the question of the antiquity of man. These included a portion of a horn of Reindeer, with a carved profile of a man's face, found in a Glacial Drift. He considered it to be the oldest work of art known, and to his mind it was an evidence of the existence of Palæolithic man in the Glacial age. Also a carved figure presenting a human face when examined in front, and the representation of a bird or beast when viewed sideways; this he took to be one of the *Penates* of these ancient men. He also exhibited a Flint Spear-

head from a deep cutting on the west bank of the Mississippi, dug up in his presence from an excavation for the foundation of an iron furnace. This weapon was "rifled," so to speak; that is, its outline formed part of a screw, and the spear or arrow to which it was attached would in its flight produce a rotary motion, and so tend to keep in a straight line when thrown through the air. Another very remarkable specimen was a polished Flint Celt, found at Barking Side, Essex, in 1868, in five feet of gravel; this was the only Essex specimen Sir Antonio possessed. Some of the flint hand daggers exhibited, from the Peat of Denmark, were highly wrought, and the handles were ornamented to give a more perfect grip. In the collection shown us were also other curious and highly-finished flint tools—saws, chisels, &c., and one implement of very remarkable construction, highly polished, and so formed as to constitute a very perfect Gouge, with an edge wrought to form an "ogee" curve, best adapted for cutting into wood. This specimen was from America.

Sir Antonio entered into detailed particulars as to the nature and teachings of the specimens exhibited, and recapitulated the results of Mr. Croll's and Col. Drayson's observations on the causes of the glacial epochs, which had been so fully stated by him at the meeting of the Club on May 29th. He was very glad to see his friend Mr. Wallace present, and hoped that veteran naturalist would give them the benefit of his opinion, although Sir Antonio feared that Mr. Wallace differed from him, *toto celo*, with regard to this difficult problem.

Mr. Walker congratulated the Club on the success of the meeting, and said that in his opinion it would be an honour to any society to enlist the aid and co-operation of the gentlemen whose names had been announced by the Secretary and of those eminent men of science he saw around him in that room. They had had so much from him that he would only make a few remarks on the stratigraphical conditions of the district they had visited that afternoon. Mr. Walker then briefly discussed the nature and history of the gravel deposits in the London district, and referred to the possibly marine origin of the older Thames Valley gravels. In reply to Mr. Wallace, who inquired on what grounds Mr. Walker founded his conclusion that these deposits were marine, Mr. Walker stated that no remains of land animals had been found in them. The speaker made some humorous remarks with respect to his fondness for the study of the gravels, which were to him a great institution, and he could lie down any day beside a barrow of flints and enjoy himself very much. (Laughter.)

Mr. A. R. Wallace, after some prefatory remarks, said that there were one or two points in the discussion that afternoon about which he should like to say a few words. First of all he must refer to the interesting and most remarkable specimens of ancient implements and art which Sir Antonio Brady had been good enough to show them. He

was particularly struck with the stone spear-head so fashioned as to give the weapon a rotatory motion in the air, and thus increase the accuracy of flight. This specimen was especially interesting to him because it came from America. When he was travelling there he noticed that the arrows of the aborigines of the Amazon valley were fringed with feathers arranged spirally round the shafts so as to keep the weapon in a straight path when projected. In many other parts, as for instance in New Guinea, weapons are not so "rifled," and it was, therefore, a very noteworthy fact that the custom of rifling spears and arrows had persisted in America from the earliest stone ages until now.

In Mr. Wallace's opinion the carved figures of men and animals which Sir Antonio Brady had exhibited were also of the very greatest interest; they were of such intense interest that it was difficult to believe they were genuine. If he remembered rightly, the animal carvings of Reindeer, Mammoth, &c., which had hitherto been discovered were all of a period supposed to be intermediate between the Palæolithic and Neolithic ages—the "Reindeer Period" of M. Lartet; but it was evident, Sir Antonio's carvings being accepted as genuine, that such were not by any means the oldest. They had represented by them not only the animals then existing, but also the men who fed upon them; of the hunter as well as the hunted. It must be remembered that savages always depicted in their carvings and drawings their own type, and therefore we may take the figures carved upon the bones to represent the type of face which prevailed among the hunters of the Mammoth. One of the carvings presented a curious resemblance to the profile of the Duke of Wellington, and accepting that as a contemporaneous carving, they might draw therefrom the conclusion that the early hunters of the Mammoth were by no means a low and degraded race. This was an exceedingly interesting point in connection with the question of the antiquity of man. We have not made the slightest approach towards the discovery of a lower type. Although we have been enabled to trace the Old World hunter back to the Pleistocene age, he remains as much man as the most intelligent races of the present day. Of course he did not mean therefore to infer that men of a lower type had not existed, but he believed that they must go immensely further back to discover the first traces of primeval man. He did not agree with Professor Boyd Dawkins in the inference that man did not exist in the Miocene age because the animals which must have surrounded him, being of forms which had developed into other species, man would have therefore been influenced by the law of development, and in the succeeding ages would have presented characters very different from the genus *Homo* as at present existing. Mr. Wallace was disposed to think that, man having reached a certain stage of development, his physical and mental qualities would enable him rather to control than be controlled by the changing character of his environment; and there-

fore, although he might advance in his mind, his bodily structure would remain very constant. The fact that the earliest races of men yet traced out present a type similar to man now existing is rather a proof that the human species is immensely more ancient than we hitherto have had any conception.

With reference to the Glacial Epoch in Geology, Mr. Wallace said it was a subject which for upwards of fifteen years he had thought and written upon. He was glad to say that he did not differ from their good friend Sir Antonio Brady to the extent he believed. He quite agreed that the period of the Mammoth and the earlier *Mammalia* was a period close upon or within the Glacial Epoch. In point of fact he considered that the time would come when they would find that changes in climatal conditions have been the principal causes in producing the changes of plants and animals on the earth. He believed that the chief agent in inducing these changes of climate was the geographical alterations in the contours of continents by submergence and upheaval in different stages of the earth's history. He had lately been attempting to show in some detail how it was that these changes in Geography did afford us the means of explaining that hitherto insolvable problem—the mild and luxurious vegetation of the Arctic regions during the Miocene and many earlier Geological epochs. It was quite impossible to accept in its entirety Mr. Croll's explanation; but Mr. Wallace believed he had found the solution in Mr. Croll's own theory of Ocean Currents. Mr. Croll maintained that there had been alternate mild and glacial conditions in the northern hemisphere throughout the Tertiary period; but the objection to this was that all the Geological evidence showed that before the last Glacial Epoch mild climates alone prevailed in the Arctic regions, whether in the Upper or Lower Miocene, the Cretaceous, the Jurassic or the Carboniferous period;—in fact, every Geological Formation in the Arctic Regions, anterior to the Pliocene, furnished evidence of mild, and in no single instance of cold climates. Now Mr. Croll had himself demonstrated the wonderful power of the Gulf Stream in carrying the warmth of the Tropics into North Temperate and Polar Regions. At present this was the only important body of warm water that reached the Arctic Seas, but there was good geological evidence that in earlier ages the great Northern Continents—Europe, Asia, and North America—were not as now solid masses of land, but were broken up and penetrated by arms of the sea which carried other bodies of warm water northward. When this was the case, the formation of ice in the polar seas would be entirely prevented; and when there was no ice the power of the sun during the long day of the polar summer was amply sufficient to support the vegetation, the remains of which so astonish us in the Arctic Regions. The last Glacial Epoch was undoubtedly produced by the astronomical conditions which have been so well set forth and illustrated by Mr.

Croll, but it was only rendered possible by the concurrence of geographical conditions, then recently brought about, by which the greater part of the warm water of the Tropics which had before entered the Polar seas was shut out from them by the elevation and solidification of the great Northern Continents. This continued growth and extension of the land in the Northern Continent during the Tertiary period has been long known to geologists, but its importance as affecting the most powerful of all climatal agencies—northward flowing and heat-bearing ocean currents—appears to have been hitherto overlooked.

By thus modifying Mr. Croll's theory, giving greater importance to ocean currents and comparatively less to astronomical causes, Mr. Wallace believed that the difficulties that had hitherto beset all attempts to explain the mild climates of the Arctic Regions, so as to satisfy both geologists and physicists, might be overcome; and in his forthcoming work, "*Island Life*," he had endeavoured to demonstrate the correctness of these views. (Loud applause.)

Mr. Worthington Smith, F.L.S., in thanking Sir Antonio Brady and Mr. Henry Walker for their great and valuable assistance during the afternoon, suggested that caution should be exercised before concluding that the "ogee" curves on the edges of the American instrument had been actually designed; similar curves being frequent on Flint Implements of all ages and from diverse places, the curves commonly arising from the natural conchoidal fracture of the flint. In reference to the sculptured subjects said to have been derived from a deposit of Glacial age, Mr. Smith said that from the brief examination he had been able to make of them, he looked upon the carvings as undoubted modern fabrications; though found by Sir Antonio himself, yet it must be remembered objects are sometimes so placed by designing workmen that they may be apparently found by an unwary visitor. The carvings referred to by Mr. Wallace as Neolithic works from Caves were really Palæolithic, and of an immensely greater antiquity than Neolithic work. As to the polished Celt said to have been found in five feet of gravel at Barking Side, Mr. Smith said he had no doubt that this was an error of observation, and that the Celt did not point to the comparative modern epoch of the Mammoth, or the great antiquity of the men who polished their stone weapons. He thought there could be no doubt that this Celt was British or Neolithic, and was originally embedded in the surface soil. Gravel diggers, in making a "fall" with their crowbars, throw surface-soil, loam, sand, and gravel all down to the bottom of the pit together; and although this Celt was no doubt found at the bottom of the pit, yet it undoubtedly belonged to the modern soil at the top. Such instances were common; Neolithic implements and flakes being profusely spread over Essex, nothing was more frequent than the finding of some comparatively modern object at the bottom of a gravel pit. The colour as

well as the nature of the Barking Celt showed that it had not come out of undisturbed gravel. The speaker then said that he, like Mr. Wallace, often felt considerably puzzled with some of the gravels of Essex, Middlesex, and Kent; and if the Dartford gravels were really marine, as stated by Mr. Walker, it must still be remembered that implements made by primæval man, and of the same immense age as the Dartford marine gravel itself, were found deeply embedded in that matrix. Mr. Smith said that while Antonio Brady had been chasing the Mammoths with such admirable success, he (the speaker) had been hunting for the works of those remote primæval men who long ages ago lived in Essex as companions and hunters of these huge beasts. He gave a list of objects he had lately secured from a small piece of sewer excavation through gravel on the west side of the Lea, Lower Clapton. This list included among many other bones, the greater part of one bone of a Mammoth's leg, four fine Palæolithic implements of flint, many "flakes," a large number of shells of land and fresh water *Mollusca*, carbonised leaves, and small branches of trees and pieces of drift-wood. He had also found a very large pebble of Grey Granite in the Lea sands at Shacklewell; and he had seen disinterred from the bottom of the gravel at Hackney a boulder of trap rock weighing $1\frac{1}{2}$ cwt. An immense block of sandstone was found at the same place weighing between 4 and 5 cwt. Mr. Smith gave it as his opinion that these great stones were probably brought down in very remote times from the North on Icebergs, and were dropped by the melting ice in the positions where now found.

Some little time was spent in examining the various objects, and commenting thereon, and about nine o'clock the members separated, well pleased with their first visit to the Mammoth's grave in the ancient clays and sands of Primæval Ilford.

[The Editor has endeavoured to give as clear an idea as possible, in a condensed account, of the statements of the various speakers respecting the many difficult questions raised during the afternoon's discussion. He thinks it, however, right to add that Sir Antonio Brady has since expressed his firm belief in the genuineness of the works of Palæolithic humanity exhibited at the meeting; and Sir Antonio further remarks (referring to Mr. Worthington Smith's criticisms), "if manufactured by designing workmen more would probably have been made, whilst mine are the only specimens known to exist."]

SATURDAY, AUGUST 28TH, 1880.—ORDINARY MEETING.

The Ordinary Monthly Meeting was held at the Head-quarters, Buckhurst-Hill, at 7 o'clock, the President in the chair. The minutes of the meeting at Ilford were read and confirmed, and the following

persons were elected members of the Club:—Walter Crouch; the Right Hon. Lord Carlingford; the Right. Hon. the Earl of Essex; William Fawcett; W. R. Fisher, M.A., Barrister-at-Law; William George; David B. Jones; Rev. Alfred Leeman, M.A.; Edward Martin, B.A., F.Z.S., Barrister-at-Law; Miss Eleanor A. Ormerod, F.M.S., M.E.S., &c.; Arthur Priest, M.D., &c.; the Right Hon. Lord Reay, D.C.L., F.R.G.S., &c.; the Right Hon. the Earl of Rosslyn, M.A., F.Z.S., &c.; W. Pickett Turner, M.R.C.S., &c.; Lord Walsingham, M.A., F.Z.S., M.E.S., &c. The names of three candidates for election at the next meeting were read.

The President, alluding to the lamented death of Mr. George J. Thompson, a member of the Club, who was drowned whilst bathing at Budleigh, Salterton, on July 28th, said the unfortunate fate of Mr. Thompson was probably known to all present, and he thought it their duty to pay that slight tribute to his memory.

Mr. James English exhibited some leaves of the common Cottage-garden shrub, *Lycium barbarum* (the "Tea-tree"), to which were attached specimens of a small moth (*Camptogramma bilineata*). The moths had evidently died in the position in which they were found, and Mr. English asked whether a like mortality had been noticed in other species of *Lepidoptera* in the perfect state. The bodies of the moths were apparently fastened to the leaves of the plant by some exudation or growth from the insect, and he suggested that the insects had been killed by a *fungoid* disease similar to that which so commonly attacks caterpillars of *Lepidoptera*.

The President thought it would not be right to infer a similarity between the two phenomena, without further investigation.

Mr. W. Cole referred to an analogous exhibition by Mr. Boyd at the Entomological Society some years ago. The insects were Trichopterous (*Brachycentrus subnubulus*); and they were congregated in hundreds on the underside of a leaf of the Comfrey (*Symphytum officinale*), and all in a dead or dying state. No explanation had hitherto been made of this curious occurrence.

Mr. Robarts suggested further careful observation and experiment with various plants and insects, as likely to afford interesting results.

The President said that being engaged on a translation of Dr. Weismann's "Studies in the Theory of Descent," he was desirous of obtaining some practical information with respect to the biological history of certain caterpillars. He wished particularly to be furnished with instances, drawn from personal observation, of caterpillars which, feeding on trees in the autumn, and hibernating, were compelled in the spring to betake themselves to low growing herbs for subsistence, the buds of the trees not opening until later in the season.

In the course of conversation, called forth by the President's request, Mr. Argent stated that he had some *larvæ* of *Sphinx ligustri*

found feeding on *Laurustinus* and some found on Lilac. The caterpillars on the *Laurustinus* were of a much darker green colour than the Lilac feeders, which latter were of a pale bluish-green, although the leaves of the two plants on which they fed did not much differ in depth of tint.

Mr. N. F. Robarts, F.G.S., exhibited some fossil corals and shells which he had lately obtained from the Carboniferous or Mountain Limestone at Llangollen, North Wales. He gave a brief exposition of the fossils and the characteristics of the formation in which they occur.

The President announced that two Forest Field Meetings were in course of arrangement: one in September, under the direction of Professor Boulger, F.L.S., for the observation, more particularly, of the autumnal flowering plants of the Forest, when the Professor would deliver an address on "Botanical work to be done;" and the other on October 2nd, when two celebrated Fungologists, Dr. M. C. Cooke and Mr. Worthington Smith, F.L.S., would expound the rich cryptogamic flora of the Epping woods.

At the *Conversazione*, Mr. English exhibited an extensive and beautiful series of the larger *Fungi*, gathered the previous afternoon in the woods above Epping. The collection included many rare species, as *Boletus setanus*, *Thelephora clavicularis* (a new species within the last four or five years), and *Gyromitra esculenta*, the plant exhibited being only the second Epping Forest specimen known, &c., &c. He also brought up a specimen of the pretty and rare Snapdragon (*Linaria spuria*) from Epping. Mr. H. J. Barnes exhibited a fine fossil *Echinus* in flint, from the "Cuckoo Oak" Gravel Pits, Fairmead Bottom. Messrs. W. and B. G. Cole showed a number of living specimens of characteristic littoral plants, gathered the previous day on the "Saltings" at Brightlingsea, St. Osyth, &c., Essex, and also a long series of the British *Geometra*, from their cabinet.

SATURDAY, SEPTEMBER 11TH, 1880.—FIELD MEETING.

Our trysting place this afternoon is at Theydon Bois, and our purpose is to note and examine the floral riches which early Autumn scatters with lavish hand in hedgerow, field, lane, and coppice. During the month of August no meeting had been held; so many members, it was thought, would be gratifying that yearly longing for sand and shingle, and a gulp of the fresh breezes vexing old Neptune's restless domain, which has struck so deeply into our modern insular life. So this is our first *r  union* since we met at the Mammoth's grave at Ilford. Our organizers had looked forward to a large and pleasant meeting, and had secured the kind aid of our colleague, Professor Boulger, F.L.S.,

F.G.S., as the botanical "Guide, philosopher, and friend" of the expedition. In vain, almost, their care:—

"The best laid schemes of mice and men,
Gang aft a-gley."

The day's meteorological horoscope, since the earliest hours, had been crossed with malign influences. Some of our members, watching for the dawn and the Deer near Monk's Woods, had seen the sun rise with auroral splendours—the ominous "red sky in the morning" of the shepherd's rhyming adage—and gloomy forebodings of the predicted sea-borne storm filled our minds. However, as we cross the railway at Theydon Gate, the afternoon, at worst, is but dull and sullen; we strike up the lane towards Theydon Garnon Church, some thirty of us, hopefully but doubtfully. Here is plenty of work for our botanists, particularly in a piece of broken ground to the right of the lane; the spot is quite choked up with many kinds of weeds, common but welcome to the sight. Several species of *Veronica* and *Epilobium* (Willow-herbs) in profusion; the charming little Enchanter's-Nightshade (*Cicca*), *Ranunculus sceleratus*, Teasels, Spurges, and fifty other plants can be gathered in blossom or in fruit. Even the lane itself is gay with Willow-herbs, Fleabane (*Inula*), Wound-worts, St. John's-worts, Cranesbills, and Ragworts; whilst the amateur botanist's *crux*, the order *Compositæ*, is in great force. Our geologists stop to examine a section of the chalky boulder-clay exposed on one side of the lane, albeit a hidden fear of local boards and road-surveyors checks the free use of the pick and hammer. The route chosen for our ramble is truly a pretty one: pleasant flower-decked lanes, shut in by hedges of Black-thorn, Dog-wood, Spindle, Maple, Hazel, Honeysuckle, and Briars; with long aisles of Nature's own Gothic architecture: tall Elms and Lindens meeting over-head, and blotting out now and again broad views of fertile valley and swelling upland, where quiet Essex hamlets and homesteads, red-tiled and gabled, nestle warmly amid the deep green trees in the distance; fair meadows and stubble-fields in which child-gleaners still linger and claim "largesse" from the wayfarer; deep shady woodlands, and an antique church, rich in memorials of forgotten grandeur and past renown. The programme is surely tempting, and with only a fair share of old Sol's ever welcome beams, the enjoyment of the "meet" would have been ensured. But no! At an early period of our ramble dense masses of vapour form and re-form under a leaden sky with vicious and presaging aspect. In vain we encourage ourselves with rash prophecies; we feel that our doom is written on the contracted and lowering horizon in unmistakable characters.

At the church we are welcomed by the Rector, Sir Cavendish Foster, Bart., who kindly takes upon himself the office of cicerone. The Rectory garden is of good old-fashioned type, designed ere carpet

bedding had spoilt our taste; it recalls Lady Corisande's garden described in "Lothair;" full of sweet-scented honest flowers, unmarred by the often perverted skill of the florist, and with many a tall tree and cool leafy nook. The garden gate opens into a fine avenue of Limes and Chestnuts, and so into the Churchyard. You cannot but note and admire the lofty red-brick tower of the Church, weather-beaten and ivy-clad; the ancient and well-kept cottage of the sextoness, with latticed windows and clean white-washed walls, serving to "set off" the red tower hard by; the Yews and Shrubs bordering the trim walks, or shielding many a stately tomb and daisy-studded grave; tall Elms, untrammelled and luxuriant, surrounding and framing in the whole. It is a charming spot on a sunny summer morning, fresh and secluded—the prettiest of God's-acres!

The Church, dedicated to All Saints, is of great interest to the Antiquary and Genealogist. The date of its erection is probably not known, but on the south side of the tower is a stone recording the contribution of Sir John Crosbie and Dames Anne and Agnes "his wyfs" towards the making of "thys stepyll." This worthy merchant lived in the reigns of Henry VI. and Edward IV., and died in 1475, so that the church can claim a very considerable antiquity. In the nave is a brass plate to the memory of the Rev. William Kyrkaby, who was rector of Theydon Garnon, and died in 1458. The church was restored, chiefly by the present Rector, between the years 1863 and 1873. All visitors must be struck by the unusual number and interest of the monumental tablets, many of them relating to personages figuring in our English annals. Sir Cavendish Foster conducts us over the church, and carefully points out the special objects worthy of attention. He had himself prepared copies of many of the more notable inscriptions for our information. It is curious, but exasperating, to note how studiously the Puritans have chipped out or otherwise erased all phrases savouring of the "Scarlet Lady"; not a single "Pray for the soul" escaped their zeal, and all the older monuments are thus disfigured. We examined the register, which commences in the year 1558, and contains many curious records of social manners. There is a large muniment chest full of documents, which would no doubt repay a careful investigation. Altogether a most interesting building; and on the motion of our President we cordially thank Sir Cavendish for his kindness and courtesy.

And now what is to be said as to the rest of our walk? The rain begins in good earnest soon after leaving Theydon Garnon, and our subsequent adventures are to be wept over rather than recorded. Botany, of course, is at a discount; practical meteorology absorbs our whole faculties, and "Forward as quickly as possible" is the word of command. Two or three of the more enthusiastic do indeed stop to note the extreme abundance of the curious plant *Bartsia* (*Euphrasia*) *odontites* in one meadow, along with the charming little *Lotus corniculatus*;

and in another field, near the hamlet called "Ivy Chimneys," the equal luxuriance and plenty of the purple flower heads of *Scobiosa succisa*, anent which Old Parkinson sayeth as follows:—"Fabulous antiquity (the Monkes and Fryers, as I suppose, being inventors of the fable) said, that the Devill envying the good that this tribe might do to man-kinde, bit away part of the roote, and thereof came the name *succisa*, Devill's-bit." We recall this fragment of mediæval phytology as we surmount the last of a long series of tall and difficult Essex stiles, find a piece of decent road ahead, and follow our leaders with all speed to the "Wake Arms." A little damp we may be, spite of waterproofs and umbrellas, but all disposed to conquer circumstances and be as jolly in face of discomfort as a field club of Mark Tapleys; even the ladies "smile a kind of sickly smile," pardoning Jupiter Pluvius; and Mrs. Gearing's warm tea and excellent providings give us courage soon to laugh at our misadventures.

Anon comes Professor Boulger's impromptu lecture, "Botanical work to be done"—problems that is in plant life awaiting solution, and solvable by amateur botanists when they shall tire of mere collections of dried leaves, and begin to look upon plants as living forms, of the nature and structure of which we are, to a great extent, profoundly ignorant. In his opening remarks, the Professor takes exception to the word "primæval" as applied to Epping Forest; in his opinion, the Forest is, both geologically and botanically, remarkably modern. When we hear the Essex Forest spoken of as "the forest primæval," we ask in what sense the words are to be taken. Are we to go back to remote geological times—the true primæval forests of the period of the London clay? In the Isle of Sheppy abundant evidence may be found of the existence of a tropical forest at the time the London clay was deposited. The land was then clothed with a luxuriant *flora*, probably resembling that now found on the banks of the Ganges; since the fruits of the Screw-pines (*Nipadites*), for example—amongst the commonest fossils at Sheppy—are there represented by the living genus *Nipa*. Then come the forests of the late Eocene, or Miocene, age; with Tulip-trees, Magnolias, Banksias, Vines, and the *Sequoias* of Bovey Tracey—a flora reminding us of California. A colder period succeeds—the period just before the Glacial epoch; and at Cromer, in Norfolk, we have the old forest beds, consisting mainly of *Pinus sylvestris* and *P. excelsa*, representing a climate perhaps very similar to the northern parts of Scotland. In yet more modern (Post-glacial) times we have the submerged forests of Oaks and Hazels at the mouth of the Thames, marking the incoming of a flora contemporary in Denmark with Neolithic man, and recorded in such names as *Thorrock* (Thor's Oak) and *Acton* (Oak-township). High "Beech" and our finest Elms probably are post-Roman in date; whilst the Hornbeams, which "lopping" has rendered so prematurely antique in appearance, are

perhaps never two centuries in age, and may only have "come in with the Conqueror." Though valued only as covert for game, our English forests probably owed some little planting, besides protection, to the Norman. Gurth, and his acorn-eating swine, was ousted by the foresters of Malvoisin.

So also the rest of our flora should be studied. Following up the fine "Flora of Essex," by Gibson (unfortunately a scarce work), we should endeavour to trace the history of the introductions of Nature and of human agency, and by careful study of so-called "critical" species, or "splits," we may be able, even in the tributaries of the Thames, or at least in the main watersheds of England, to illustrate those laws of geographical distribution which have been shown in the case of the Amazons.

At the same time, we should learn the lesson of Continental botanists; trace every stage of development in any plant we can; study every phase of physiological life by field observation, as well as by laboratory experiment: not omitting the minute discrimination of the much maligned "species-monger." In fact, the Darwinian must note details even more than the mere species-discriminator, since he looks for the intermediate variations that the latter would rather discard.

A recognition of the necessity for thoroughness in the many new fields of work suggested by the Theory of Evolution must necessarily lead to an increase of specialism; but the lecturer thinks that the local Field Clubs have an important function to perform, to some extent counteracting this tendency, in keeping alive that fine old type, now in danger of sharing the fate of our Ilford Mammoths, the "good all-round" naturalists. This is a type represented by such men as John Ray—name dear to Essex—and Gilbert White, naturalist and poet. Such Clubs also bring together students of various branches of science, and so teach us to appreciate work in directions untrod by our own footsteps, and to learn the true proportions of our work to the general scheme of Nature.

An eminent geologist once said to the lecturer, "Botany! what's to be done in botany? Our plants are all known as well as the butterflies." It may be enough to reply that one or two plants "new to Britain" are discovered nearly every year, even among Phanerogamia. This is not, however, the sole aim of the botanist. If we turn to the base of the scale of vegetable life, we find the but newly-discovered *Myxomycetes* (perhaps plants, perhaps animals), the virtually unknown *Schizomycetes*, and the constantly increasing list of the higher *Fungi*, among which even the mushroom has not been traced with certainty through its whole life-history. The fresh-water *Algae* have not been recently monographed; the *Characeae* are unplaced, and we are much in want of a satisfactory classification of *Thallophytes* as a whole. Higher up we have the apparently causeless variation in the Ferns,

and an infinity of work in the unravelling of the web of Nature's mind, by fixing the position of numerous natural orders. We want to learn the function of the various elements of plant-food ; we want *Parnassia Helleborus*, and other "carnivores" studied as *Drosera* has been studied. We have, undoubtedly, much to learn as to the modes of branching, the inflorescence, fertilization, hybridization, flowers that never open, leaves that "sleep," the means of dispersal in fruits and seeds, plant-crystals and secretions, and many another wide-reaching topic. We cannot say that many of our "critical" groups are yet satisfactorily arranged. The aquatic *Ranunculi*, the genus *Cochlearia*, the altitude variations of Violets, the hybrid *Epilobiums*, *Cardui*, and *Verbascums*, *Arctium*, *Erythraea*, *Euphrasia*, *Atriplex*, *Potamogeton*, and others, stand in need of careful study, not to mention such well-known puzzles as Roses, Brambles, Hawkweeds, and Willows. In these cases, field-work—the examination of whole, growing plants, and their surroundings—is the chief thing of which we have as yet had too little.

The lecturer concludes by expressing a hope that his suggestions may lead members of the Club to endeavour to fill up some of these *lacunae* in our knowledge of the plant-world.

A cordial vote of thanks is given to our conductor for his deeply-interesting and suggestive remarks ; Mr. Gearing's interesting collection of coins, and other relics found on the Forest, is examined, Theydon Bois Station gained in good time, and so end our "Chronicles of a Wet Day."

SATURDAY, SEPTEMBER 25TH, 1880.—ORDINARY MEETING.

The Monthly Meeting was held at the Head-quarters, 3, St. John's Terrace, Buckhurst Hill, at 7 o'clock, Mr. R. Meldola, President, in the chair.

The minutes of the previous meeting were read and confirmed. The following were elected members of the Society:—Messrs. William Cutting, W. Elliott Hutchinson, and E. Delacourt Kell.

Mr. F. G. Hart exhibited a fossil *Ammonite* from the glacial clay at North Weald.

Mr. James English brought up a *Quail* (*Coturnix communis*) shot by Mr. Symonds at North Weald. Mr. English stated that this was the first Essex specimen that had come under his observation. [The following remarks, extracted from the 4th edition of Pennant's British Zoology, 1776, may be given here:—"A gentleman, to whom this work lies under great obligations for his frequent assistance, has assured us, that these birds (quails) migrate out of the neighbouring inland counties into the hundreds of Essex, in October, and continue there all the winter ; if frost or snow drive them out of the stubble

fields and marshes, they retreat to the seaside, shelter themselves among the weeds, and live upon what they can pick up from the *Alga*, &c., between high and low water mark. Our friend remarks, that the time of their appearance in Essex coincides with that of their leaving the inland counties; the same observation has been made in Hampshire."—Ed.]

Mr. English also exhibited a fine specimen of the rare Fungus *Thelephora multizonata* from Epping Forest. Since he had discovered the species in the Forest he had found seventeen specimens in about nine years. He believed that two examples had been gathered in Hereford, but as far as he knew, these were the only specimens recorded.

Mr. W. Cole exhibited some remarkably dwarf specimens of *Lepidoptera* all taken at large in the Forest district, Chingford and Buckhurst Hill. The species were *A. cardamines*, *Crocallis elinguaris*, *Ennomos angulata*, and *Abraxas grossulariata*. Some of these diminutive insects were less than half the normal size of the species.

The President showed some specimens of Exotic butterflies for the purpose of illustrating some interesting remarks made by him on the phenomena of *Protective resemblance* amongst insects. The specimens well demonstrated the existence of two classes of cases—one in which the insects derived protection from their enemies by reason of their resemblance to living or dead leaves, twigs or flowers. This case is well illustrated by the Indian Leaf Butterfly *Kallima Inachis*, and by many moths and caterpillars in England. The other class of cases, including those rarer species which find protection by "mimicing" some commoner species, which may itself be protected by some special quality, such as nauseous taste or odour, from the attacks of birds or other enemies. This class Mr. Meldola illustrated by *Diadema missippus*, the female of which very closely resembles the common *Danaüs chrysippus*. Among English species it may be noted that the comparatively scarce little Geometrideous moth *Acidalia subsericeata*, closely mimics the common *Asthena candidata*; and many examples of these phenomena could probably be found in British insects.

Mr. Cole mentioned that his brother had seen a specimen of *Cynthia Cardui* at Ramsgate, hovering over and settling upon some artificial flowers in a lady's hat. The observation was worth recording, as it tended to show that the colour and form of flowers were the chief attraction to insects.

Mr. N. F. Robarts, F.G.S., wished to call attention to the Deer in Epping Forest, in the hope of eliciting some information with respect to their peculiarities. When compared with the ordinary Fallow-deer of our parks, he thought they presented noticeable differences, and they appeared to be a separate race. He also wished to know whether the cause of the mortality of the Shrew-mouse (*Sorex araneus*) was

known. He had often seen them lying dead on paths with no signs of injury.

The Secretary said he had also frequently noticed dead Shrews, generally, he believed, in the autumn. He suggested that sharp night frosts may be answerable for the death of these much maligned little creatures. He could confirm Mr. Robarts' remarks with respect to the Epping Forest Deer; they presented race characters in colour as well as in the absence of decided palmation of the antlers, thus being curiously without one mark of the species; they were probably much more ancient than our semi-domestic Fallow-deer. It was not generally known that Red-deer existed in a wild state in Hainault and Epping Forests until a comparatively late period. He had a map in his possession with manuscript notes by Mr. John Cary, the celebrated map engraver. In one note Mr. Cary stated that on October 20th, 1827, he had assisted at the hunt of a Red Stag, which was finally taken at Plaistow, adding, "Red Deer to be so near the Metropolis in their wild state I consider as a singular circumstance." This event took place, of course, long before the disgraceful and lamentable destruction of Hainault Forest.

Mr. English read a paper on the preservation of flowering plants so as to retain much of their form and colour. This process is an improvement on that proposed by the author in a communication to the Club on April 24th last. (See Transactions, Vol. I., p. 71.) Mr. English exhibited a large box filled with beautifully preserved specimens, comprising more than fifty species. Some of the plants presented a most life-like appearance; and as the forms and scientific characters are often well retained, the process bids fair to be of very considerable value, especially for the production of museum specimens and for educational purposes. Mr. Saward also exhibited specimens of the same nature. Thanks were returned to Mr. English for his communication.

The President called attention to the Field Meeting to take place on October 2nd, for the study of the *Cryptogams* of the Forest, under the leadership of Dr. Cooke, Mr. Worthington Smith, and Mr. English, and mentioned that it would probably be the last field meeting of the season.

At the *Conversazione*, Mr. C. Thomas, F.G.S., exhibited under the microscope the following living objects:—*Chara translucens*, for the purpose of showing that beautiful and wonderful phenomenon the circulatory movements of fluid protoplasm within the cells of the plant commonly called *Cyclosis*. Also amongst the *Rotatoria*, the charming *Floscularia ornata*, *Æcistes crystallinus*, and *Limnias ceratophylli*, all from the neighbourhood of Epping Forest.

SATURDAY, OCTOBER 2ND, 1880.—FIELD MEETING.

How frequently we have the enquiry from incipient naturalists, "What shall I study—how shall I begin?" Those who attended this meeting had both precept and example to direct their choice, and to point the way, into one at least of the byepaths of Nature which it is the duty and pleasure of the naturalist to tread. The byepath is one which needs careful journeying, for it is strange and difficult, and often but dimly defined, although full of interest, and beauty, and wonder, to the enthusiastic wayfarer. It traverses the province *Cryptogamia*, once of great empire and dignity in the kingdom of Nature, but now seen of humbler guise; our horsetails, ferns, and mosses are but dwarf and degenerate descendants of the gigantic *Lepidodendra*, Tree-ferns, and *Calamites* of the Devonian and Carboniferous ages of the earth's history. But fortunately for us, size is no measure of merit; the great *Sigillaria* could we have seen them growing, wildly luxuriant, in the reeking forests of the coal-period, would perchance have taught no higher biological lessons than can be gathered from the study of the humble club-mosses of our native woods and heaths. And how much there is of interest in the history, but very partially known, of that mysterious tribe called *Fungi* by the learned, and Toadstools, Mushrooms, and Moulds by the general. Flowerless they are by name and nature, but often of striking beauty. A search in Epping Forest any fine morning in this present month of October will reveal many a cryptogamic gem; the brilliant Fly-Agaric, with its scarlet crown; the coral-like *Peziza aurantia*, or the golden yellow *Clavaria*, found springing up in luxuriant clusters by woodland paths and hedge-rows. Here then is a "hobby," attractive and comparatively unriden; and our Forest is the very place in which to exercise it; Epping being perhaps one of the best localities for the larger *Fungi* in England. And at the meeting we chronicle what better teachers could the developing mycologist desire? Dr. Cooke, the hero of a hundred fungus forays and author of many a recondite treatise and popular history anent his favourites, was on the Forest betimes, in company with a portmanteau of wondrous capabilities, destined ere the day was over to be the resting-place of many a rare *Agaric*. With him was Dr. Wharton, M.A., F.L.S., himself an accomplished mycologist and ornithologist. Later trains brought to Loughton Professor Maxime Cornu, of Paris, of European reputation as a fungologist; our kind friend Mr. Worthington Smith, F.L.S., to whom our members were indebted for the jocular woodcut which proved so attractive on the programme of the day's proceedings; Mr. James English, than whom no one is better acquainted with the secret homes and haunts of many a rare Epping fungus; Mr. E. M. Holmes, F.L.S., an authority on mosses, lichens, and sea-weeds; Mr. Howse, the Woolhopean; the High Sheriff and Verderer, Mr. Andrew Johnston, and upwards of fifty members and friends, including several ladies. Never was a Naturalists'

excursion better officered, and the President and Secretary were full of congratulations as they conducted their batch of visitors towards Monk's Woods, the appointed afternoon rendezvous. Alas! just as we entered the broad shadow of the trees, down came the rain, sullenly and remorselessly. In vain did we shelter ourselves, "*sub tegmine fagi*," making occasional sallies into the open to secure some particularly large or fascinating Fungus. We soon became uncomfortably moist, and when Mr. Smith's and Mr. English's parties appeared, crossing a sedgy wood opening, and looking if possible even wetter than ourselves, we, after a brief consultation, adopted the advice of the "*veterans*," and struck the woodland path across the valley to the "Forester's Arms." Just outside the woods we met the last arrivals from the station, and the united parties fled before the pitiless tempest. A short lull in the storm tempted us to make another incursion to the woods, but we could not get far. However, we found Dr. Cooke's party loaded with spoils. The genial Doctor's wonderful bag was stocked with type specimens for his Lecture, and one enthusiastic member had converted his umbrella into a temporary vasculum, preferring to bear the rain rather than run the risk of spoiling his pretty *Agaricini* and *Boleti*; whilst Mr. Grut (the well-known Librarian to the Entomological Society) carried in triumph an immense *Boletus edulis*, 2 feet $4\frac{1}{2}$ inches in circumference, which he had gathered at High Beach. But the downpour soon forced the botanists back. Just outside the Forest a large specimen of the "Parasol Mushroom" (*Agaricus procerus*) was noticed, a species of very fine edible qualities. Listening to the chatty reports of the skilled botanists, it was soon evident that in spite of bad weather the afternoon's hunt had proved very successful. Doctors Cooke and Wharton had gathered nearly sixty species, including many rare and remarkable forms, particularly the generally scarce *Agaricus ericeus*, which they found commonly. But their greatest prize was *Agaricus udus*, a species new to Britain; this interesting species was found in great plenty. Mr. Worthington Smith also found on dung numerous specimens of *Agaricus sphinctrinus*, which he took to be new to our flora; but on this point Doctors differ, and Dr. Cooke informs the writer that the species has been already recorded. Mr. Smith had been busy determining and registering the species met with, and his list extended to more than forty species. Amongst the notable forms recorded by him may be mentioned *Agaricus radicosus*, growing from the ground on hidden stumps. It has pink gills and mimics the common mushroom, for which it could be easily mistaken, but it is very poisonous and dangerous. *Ag. sublateritius*, a new form of this species with deeply decurrent gills. The orange Chantarelle (*Cantharellus cibarius*), a pretty species with an odour like apricots, and which is so good when cooked that a botanist once said that a well-prepared dish of it would arrest the pangs of death, was very common in Monk's Woods, and at High Beach.

A. mucidus was very handsome, with its beautifully white gelatinous pileus, growing in overlapping clusters on the beeches; and here the edible *Hydnum repandum* was springing from the ground in abundance, Professor Cornu stating that it was sold in French vegetable markets at 3d. per pound. *Agaricus mappa* was frequent with the poisonous *A. semilanceatus*, *cervinus*, *spectabilis*, the edible *campestris* (Mushroom), and the somewhat uncommon *Ag. sericellus*. Further on were *Ag. lacrymabundus*, *pyxidatus*, *rhodopolius*, *pascuus*, *fastibilis*, *Saponaceus* (smelling of soap), *amethystinus*, *mollis*, *squamosus*; the edible species *rubescens* and *excoriatus*, and many common forms too numerous to mention. Mr. English met with many interesting fungi. Near High Beach was a beautiful group of *Agaricus radicans*, with its gelatinous cap, pure white gills, and elongated stem rooting deeply by the side of an old stump, the other side of which was clothed with *Polyporus adiposus* nestling amongst the moss, accompanied by *Stereum purpureum*, one of the leathery group of fungi. On another stump was *Bulgaria sarcoides* and a pretty yellow *Periza*. These old beech stumps seem very prolific in fungi and will often repay a search. Near the "King's Oak" the edible *Boletus* (*B. edulis*) was in plenty, some young plants of which Mr. Fitch carried home, had cooked for breakfast, and reported well of the dish. Several species of the genus *Russula* occurred, and with them the brilliant scarlet *R. emetica*, very showy but very poisonous. Also the rarer *Russula cyanoxantha*, an edible species, as well as the hurtful *R. furcata* with *R. satans* (stinking and poisonous) and *lutea*. Young specimens were seen of the Fly-agaric (*Amanita muscarius*), groups of the large *Lactarius vellereus*, a poisonous species, and *Ag. phalloides*, with the hateful smell. Also *Lactarius insulsus*, *quietus*, *piperatus*, *serifluus*, and *subdulcis*. On the trees *Polyporus cuticularis*, *Dadalea quercina*, *Trametes gibbosa*, and *Tremella albida*. A few Puff-balls were common, as well as *Paxillus involutus* and *Clavaria pistillaris* and *cristata*. But to mention by name all the Nature's rarities found would only weary the reader by reproducing on a small scale a "check-list" of our British fungi.

Discussing thus the spoils of the day we wandered back to our Inn, and we were soon enjoying one of those sociable "teas" which are so familiar to the members of "Our Club," and which proved very acceptable to many after a long and fatiguing Forest ramble.

After tea the President had much pleasure in stating that the Epping Forest Committee of the Corporation of London had agreed, in accordance with a motion made by their distinguished colleague, Mr. Andrew Johnston, to sanction the thorough examination by the Club of the ancient earthworks in Epping Forest. The work would be commenced as soon as possible, but as large funds would be required, the Council asked for liberal contributions from members and others interested in archaeological discovery. With respect to the afternoon's results, he thought they had great reason for congratulation, notwithstanding the weather,

which had proved so inclement on that and several other former Field Meetings. On looking along the tables, the officers of the Club could not but feel proud to note the large and eminent cryptogamic forces they had succeeded in bringing together. He was sure all were deeply indebted to their conductors, Dr. M. C. Cooke, Mr. Worthington Smith, and Mr. James English, for their valuable assistance, and as some members might be obliged to leave before the termination of the discussion, he proposed to reverse the usual order of things, and at once call upon the meeting to pass a cordial vote of thanks to the botanists named. In doing so he could not but refer to the many well-known naturalists who attended the meeting as visitors, and he was sure all were proud and pleased to welcome their illustrious *confère*, Professor Maxime Cornu, of Paris, among them that afternoon. The vote of thanks was given with much cordiality and enthusiasm.

Dr. Cooke then delivered one of his characteristically humorous and learned extemporaneous lectures, taking as his subject the discrimination of *Fungi* generally, and edible and poisonous species in particular. He alluded to the extreme richness of the Epping Woods in this class of plants, and congratulated the Society on having inaugurated so successfully a much-wanted mycological meeting. Since the collapse of the Fungus Meetings of the Royal Horticultural Society, lovers of these lowly plants had had no opportunity of meeting together for pleasant conversation and comparison of notes, and he was sure, should the meetings become an annual institution, they would be much appreciated by metropolitan botanists.

The Doctor gave an admirable *résumé* of the characteristics of the principal families of the larger or pileate *Fungi*, illustrating the points insisted on by means of fresh specimens extracted from the hidden recesses of his wonderful portmanteau. He described the mode of examining specimens with a view to classifying and naming them—whether with gills, pores, or teeth, on the underside of the pileus; the colour and nature of the spores, the structure of the stem, whether solid, hollow, or fibrous, the attachment of the gills to the stem, &c., &c.; all these points were touched upon, and demonstrated practically with the aid of a table knife, and the inexhaustible bag. He also pointed out what species to select, and what to avoid from a gastronomic point of view, particularly praising the "Orange Chantarelle," alluded to above; and one species *deliciosus* of the genus *Lactarius*, known by exuding a milky fluid when broken. Our giant friend *Boletus edulis* came in for a large share of commendation, and the visitors were told to study its characters well so as to know it again, particularly remarking the delicate pinkish reticulation of the stem which serves to distinguish the right species from its congeners, many of which are the reverse of wholesome. One of these *Boletus luridus* had been found plentifully during the afternoon's hunt. It is poison-

ous and turns to an azure colour when cut or broken, and Dr. Cooke thought the plant was designed by Providence to indicate "blue ruin" to the unwary fungus-eater!

Mr. Worthington Smith thought the Doctor had made a slight slip in stating that *Lactarius deliciosus* was the only edible member of the genus, as the allied *L. voleumum* grew in Epping Forest, and was universally allowed to be one of the greatest gastronomic delicacies in the family of mushrooms. He had been several times asked during the afternoon whether there was any general rule for distinguishing an edible from a poisonous species; no such general rule existed. *Fungi* like other natural objects required to be studied to be well known. In addition to the anatomical details mentioned by Dr. Cooke, Mr. Smith stated that there were many empirical characters of great importance in the discrimination of *fungi*. For instance, the habitat is always of great value, and notice should be taken whether the fungus to be determined grew in a wood, a hedgeside, or meadow. If in a wood the character of the trees should be noted; some *fungi* are peculiar to Fir woods, others to plantations of Beeches, Larches, and other trees. If the *fungi* grow on trunks or stumps, especial attention must be paid to the nature of the trunks, whether of Oak, Elm, Beech, Fir, or any other tree or bush. The same rule applied to fallen twigs and dead leaves. The habit also was of great value, whether growing in a solitary manner, in groups, in "fairy-rings," one or two together, or in great companies. Coming to the plant itself, Mr. Smith said that as there were about 1,000 species of mushroom-like *fungi* in this country, it was evident that only the most careful examination of all parts of the structure, stem, pileus, gills, and spores would enable the botanist to discriminate many critical species. Especial attention should be paid to the top, whether it is fleshy or thin; its "flesh" dry, watery or milky; its upper portion smooth, rough, warted, or gelatinous; the *stem* may be rough or smooth, with or without a ring, springing from a bulb or from an attenuated root-like growth, hollow or solid, with or without bark, have pith or be pithless. The gills or plates under the top must be noted, whether these structures are thick or thin, crowded together or distant from each other, whether running down the stem or free from it, and whether the colour is black, white, pink or brown. The spores are equally important; their colour, form and size must be observed with care in the discrimination of critical species. Some spores are very large, as in *Agaricus mucidus* (found that afternoon); whilst others, as in *Polyporus casius*, are excessively small; some are round, others oval, some pip-shaped, some nodulose, others furnished with spines like a hedgehog. Odour, too, is of great importance as an empirical character, said Mr. Smith; different *fungi* are furnished with the most diverse smells, and many can be named at once by the fragrant or foetid scent alone. Taste was of equal importance, some

fungi being sweet and nutty to the taste, others bitter and highly pungent.

Professor Maxime Cornu, who was very cordially received, and who spoke in French, said he felt much flattered by the honour they had done him. He was very charmed to be able to be present at such a pleasant *réunion* of London botanists. In his opinion, meetings of the kind had the greatest scientific interest independently of their social and friendly character. He hoped, on his return, to initiate similar meetings in Paris, and he need not say that any he saw around him would find a hearty welcome there.

A few practical observations on fungus hunting were made by Mr. Howse and Mr. Holmes, time forbidding any further extended remarks, and then the party sallied forth to catch the train at the Loughton Station. Shining like "a good deed in a naughty world," our leader's entomological lanthorn signalled the way through the almost impenetrable darkness, and enabled us to steer our course without much discomfort. Mr. Smith records some of the conversation of the experts as they trudged through the Essex lanes. In reference to the darkness, M. Cornu said that Dr. Quelet could recognize several species of *Hydnum* in the dark by merely squeezing the hymenial surface between his fingers and noting the amount of moisture exuded. Someone else said he could always make out *Phallus impudicus* in the dark, even *without* touching it, and Mr. English said he always knew the poisonous *Russula emetica* from any other species because the red colour of the pileus invariably got washed out and dissolved over the gills by his hot wax process—a character, so far as he knew, peculiar to this species. He also said *R. emetica* turns brownish-black in drying. These characters (if they are to be relied upon) are very valuable, as no species is more difficult to make out with certainty than *R. emetica*, its characters being closely "mimiced" by several other red *Russulas*, said Mr. Smith. The rain holding off for a brief space, and friendly converse so beguiling the time, all ended happily, and the LAST Field Meeting of the season is, in everything but the weather, a pleasant memory.

[In penning the last gossiping report, the Hon. Secretary cannot refrain from taking the opportunity of publicly thanking all friends, scientific and others, to whose kind aid and encouragement the success of the first series of these pleasant gatherings has been mainly due. In spite of bad weather, the interest taken in them by the members has never waned, and we may hope that the next season's meetings will profit from the legacy of pleasant recollections bequeathed by those of 1880.]

SATURDAY, OCTOBER 30TH, 1880.—ORDINARY MEETING.

The Monthly Meeting was held at the Headquarters, at seven o'clock, the President in the chair.

The minutes of the previous meeting were read and confirmed. The names of twelve candidates for election into the Society were read.

The Secretary read the following letter :—

Aldershot, 24th October, 1880.

Dear Sir,—In reply to your letter, I am directed to state that H.R.H. the Duke of Connaught will have great pleasure in becoming a Patron of the Epping Forest and County of Essex Naturalists' Field Club.—Yours truly,

H. ELPHINSTONE.

The President said that he knew the members of the Club would hear with great pleasure of the honour conferred upon the Society by His Royal Highness, and he was sure they would gladly pass a cordial vote of thanks in acknowledgment of the favour so freely and kindly rendered.

The vote was passed by acclamation amid loud cheers.

The following letter was also read :—

Guildhall, E.C., 4th October, 1880.

Gentlemen,—The Epping Forest Committee have considered the memorial addressed by you to them on behalf of the Epping Forest and County of Essex Naturalists' Field Club, for permission to make a scientific examination of the Camps or Earthworks at Loughton, and of the Camp called Ambresbury, in Epping Forest, under the personal superintendence of Major-General Pitt-Rivers, and the following is a copy of the resolution passed by them on the subject :—

"Resolved: That the application be granted subject to the works being carried out under the superintendence of Mr. McKenzie, the Superintendent of the Forest, and to the ground being subsequently restored by the Club to its present condition and to his satisfaction; and also that all relics and other objects of interest which may be found in either of the Camps or Earthworks shall be handed over to, and become the property of, the Conservators."—I am, &c.,

JOHN B. MONCKTON.

To the Council.

Mr. Meldola said that, in accordance with the above, the Secretary had issued a circular to the members, asking for subscriptions to found a fund to be called "The Forest Camps Exploration Fund," to enable the Society to carry out the work. He was glad to say that £40 had already been subscribed, sufficient to explore one Camp; and the Council confidently hoped that further sums would be sent in as the desirable object of the fund became more generally known. Acting

under the advice of their Hon. Surveyor, Mr. D'Oyley, the Council had resolved to defer the exploration until the spring, when the earth would probably be in a condition to allow of sifting, so that coins or other small objects might be readily detected. By that time also the Council hoped that a sufficient sum would be received to enable the Club to thoroughly explore *both* Camps, and to publish in a suitable manner a full account of the investigation, with maps, plans, &c., constituting a complete history of these interesting relics. In moving that a vote of thanks be passed to the Epping Forest Committee, the President wished to bear testimony to the services rendered to the Club by their colleague Mr. Andrew Johnston, High Sheriff of the County, in proposing, in his capacity of Verderer and member of the Committee, "that the Club's application be granted," and also for his kind efforts in connection with the application to H.R.H. the Ranger. The votes of thanks were passed with much cordiality by the meeting.

The President also said, that acting upon the excellent suggestion of their Secretary, the Council had resolved to establish a series of Winter Science Lectures for the instruction and amusement of the members and the public generally. The first lecture would be given by Mr. J. E. Harting, F.L.S., F.Z.S. (Editor of "Zoologist"), on Wednesday, November 10th, subject, "Forest Animals." He was glad to be able to announce that his friend, Mr. A. R. Wallace, had consented to deliver a lecture during the course. They also hoped to secure the kind aid of Dr. Cooke, Mr. Whitaker, and other distinguished scientific men.

The following books were presented to the Society: Warner's "*Planta Woodfordienses*," a rare book of great interest to the Essex botanist, presented by Mr. Fisher Unwin, and "The Transaction of the Essex Archæological Society," Vol. II., Part I., by the Society.

Mr. English exhibited several rare and interesting species of *Fungi*, from Epping Forest, and made some remarks upon their peculiarities. *Polyporus intybaceus*, rare; he had only found this on few occasions on one particular stump in the Forest. It was a remarkable fact that the plant did not occur annually; it slipped some years, and then reappeared in the same locality. This year he had found a fine specimen; it was very beautiful, with its white pileus, studded with pores, and looking like some varieties of coral. *Agaricus storea*; that morning he had been out with Dr. Plowright, who had journeyed all the way from King's Lynn in order to see some of the Epping Forest *Fungi*. They succeeded in discovering some very beautiful things, especially this species. It only occurs on the site of a fire where there is a layer of charcoal; and it is worthy of note that many curious species are only found on these charcoal heaps. *Stereum hirsutum*, very common in the High Beach woods. *Trichia chrysospermum*, a species very interesting

to the microscopist. *Cortinarius rigens*, a very rare species and recently new; Mr. English had found it in Monk's Wood; the form very much resembles *C. ochroleuca*, although in his opinion perfectly distinct. *Agaricus ericæus*, a common species in the Epping Woods, but one which appears to be a great puzzle to mycologists; it had been returned to him under three names, *velutinus*, *stercoraria* and *squamosus*.

The Secretary exhibited some insects from his own collection for the purpose of illustrating Mr. Meldola's remarks at the last meeting on mimicry and protective resemblance in these animals. The case of mimicry was that of the little moths *Acidalia subsericeata* and *Asthena candidata* before explained, and "protective resemblance" was exemplified by many specimens of caterpillars which possess various modes of concealment.

Taking these specimens as his text, Mr. Meldola engaged the attention of his audience by a short dissertation on caterpillars, their habits and appearances, considered as means of protection from their enemies. He pointed out that many caterpillars resemble twigs, dead leaves, flowers, leaves, etc., and so escape detection. Such cases are easily recognised. On the other hand many caterpillars are hairy or brightly coloured and appear to court observation rather than concealment. Many experiments made by Mr. Jenner Weir, Mr. Butler, and Dr. Weismann, went to show, however, that insectivorous birds rejected such larvæ, probably on account of some unpleasant taste or odour. Of course it would benefit the insect but little to be bitten in two and then rejected, and Mr. Wallace had suggested that bright colours and hairs served the purpose of *danger-signals*, warning the birds of the nauseousness of the morsel. Some caterpillars have fringes of hairs just above the legs, and Mr. Meldola suggested that such hairs might be of advantage by softening the shadow thrown by the insect when stretched along a bough, and so rendering it less distinctly seen. This was the case with the larva of the "Lappet-moth," *Lasiocampa quercifolia* shown by Mr. Cole. Other caterpillars possess *eye-like* spots, and Dr. Weismann found by direct experiments that these frightened birds off the insects; his results being confirmed by the experiments of Lady Verney. In short, there was not a hair, spot or marking on a caterpillar but possessed some meaning, and indicated some trait in the economy of the species.

The Secretary read a letter from Mr. Andrew Johnston asking for information as to the correct orthography of the words "High Beach." The general opinion of the meeting was that the word should be so spelled, and not "Beech;" the words probably indicating high ground, in which pebbly gravels cropped out, so forming a "beach."*

* We have adopted the form "Beach" in the reports, but must confess to feeling considerable doubt as to its correctness; it must be noted that the word is spelled "Beech" in the Ordnance Maps, in Warner's "*Plants Woodfordiennes*," and also is so written in some MS. notes in Mr. Unwin's copy of the same work. We shall be glad of information on the point.—Ed.

Also, extract from a letter from Mr. Christy, taking exception to the explanation proposed by Mr. Cole at the last meeting to account for the death of Shrews, viz., that they were killed by exposure to sharp autumnal frosts. Mr. Christy stated that he had as often found dead Shrews in the spring and summer as in the autumn. He suggested that many of them die through fighting, as they often bear old and new wounds. Some die from other causes, however, as they often present a compound dislocation of the backbone. Mr. Christy suggested that the members should make a careful examination and record of all Shrews found dead, so that some data might be accumulated to aid in solving the question; a desirable result were it only to disprove the belief (common in Essex) that they die from inability to cross a path!

Mrs. Yeates exhibited a sample of some masses of a curious stony substance found in quantities in digging the foundations for Mr. Barnes's house, Oak Hall. They seemed very like the well-known *septaria* from the London clay.

WEDNESDAY, NOV. 10TH, 1880.

Science Lecture.

The first of the projected series of Winter Science Lectures, in connection with the Club, was given by J. E. Harting, Esq., F.L.S., F.Z.S. (Editor of *Zoologist*). The President occupied the chair, and in introducing the lecturer said:—There is an oft-quoted proverb, which tells us that "Wisdom cried aloud in the streets, and no man regarded her." In opening the present session of lectures in connection with our Club, I can only express a hope that the streets of Buckhurst Hill will not be the scene of this intellectual degeneration. The work which can be done by a Field Club is, as I pointed out in my Inaugural Address, of two kinds: original research, and the promotion of science in our own district. We thus appeal to two widely different classes: to the special scientific worker on the one hand, and to the general public on the other. In lectures such as we commence with this evening, we have a common meeting-ground for both these classes. Being fortunately situated close to the great focus of scientific activity in this country—the metropolis—we can secure the co-operation, and, I am happy to say, have been promised the assistance, of some of the most eminent among our scientific workers. We thus commence our labours as missionaries of science under good auspices, and we appeal to the outside public to show that these labours are appreciated. The President then called upon Mr. Harting, who delivered a lecture on "Forest Animals" (Transactions, Vol. I., p. 74). At the conclusion of the lecture, Mr. Meldola suggested that Mr. Harting would be happy to answer any question on matters connected with the lecture.

Mr. Andrew Johnston, in his capacity of Verderer of the Forest, asked whether there was any likelihood of the Roe Deer, and Badger remaining in Epping Forest if undisturbed there.

Mr. Harting replied that both these animals were of a retiring nature, and required to be kept absolutely quiet. If the public had access to all the coovers in the woods it would be impossible to keep them, but if they could be kept undisturbed they might do very well. The Roe Deer was of a wandering disposition, and would require a large area of forest wherein it could roam undisturbed. Therefore he thought there would be some difficulty in inducing it to remain in Epping Forest. The Badger only required protection, quiet, and water, and he thought there would be no difficulty with that animal.

A cordial vote of thanks to Mr. Harting was carried by acclamation.

SATURDAY, NOVEMBER 27TH, 1880.—ORDINARY MEETING.

The Monthly Meeting was held at seven o'clock, the President in the chair. The following persons were ballotted for and elected members of the Club:—Messrs. George Brooke, F. T. Lockyer, Thos. S. Morten, C. J. S. Parker, Rev. T. W. Peile, Edwin Richardson, G. T. Saul, F.Z.S., Miss Spicer, Messrs. W. Thorp, B.Sc., F.C.S., &c., T. H. Varley, F.R.A.S., &c., F. B. Wells, E. Wheeler.

Mr. P. Copland was chosen Auditor on behalf of the Council, and Mr. Saul on behalf of the members.

The following works were presented to the Club: Warner's "*Plantæ Woodfordienses*," by Sir J. Clarke Jervoise; Relham's "*Flora Cantabrigiensis*," Ray's "*Wisdom of God in Creation*," and Ray's "*Travels*," by Messrs. W. and B. G. Cole.

The following letter from Lieut.-Col. Russell, J.P., D.L., North Ockenden, Essex, addressed to the Secretary, was read:—

"November 10th, 1880.

"Dear Sir,—The enclosed notices of motion have been given at the last Essex Quarter Sessions, and the one of them which there seems to be best supported will be made January 4th. Motion No. 2 would meet with overwhelming support as against March 1st for beginning of close time for *all* birds, but No. 1 is, I think, better in itself, and is preferred by the men near the coast on whose land large numbers of Ducks breed, by Decoyholders, and by shooters of all sorts. I shall be glad to know the opinions and wishes of the members of the Epping Forest Naturalists' Club on the subject, with a view to try and get done what will be most generally suitable. With the exception of the few migrants mentioned in (1), which do not breed in this county, and whose numbers experience shows not to be affected by close time in this county, everybody seems willing to let the birds have close time from the 1st of March.—Yours faithfully,

"C. RUSSELL."

The resolutions referred to above:—

"(I.)—That this Court do apply to the Secretary of State for the Home Department to vary the close time under the Wild Birds Protection Act, 1880, for this county in manner following, that is to say: That the close time as regards the Curlew, Dunbird (including Scaup Duck), Gedwit, Knot, Oxbird, Plover (not including Lapwing), Snipe, Widgeon, Wild Goose, and Woodcock, extend annually between the 1st day of April and the 1st day of August." *

* At the meeting of the Essex Quarter Sessions held on January 4th, 1881, the above (first) resolution was carried, on the motion of Lieut.-Col. Russell, seconded by Mr. J. Round, M.P.; and upon the proposition of Mr. Round, seconded by Mr. E. N. Buxton, it was agreed that the following gentlemen be appointed a Committee to

"(II.)—That this Court do apply to the Secretary of State for the Home Department to vary the close time under the Wild Birds Protection Act, 1880, for this county in manner following, that is to say: That the close time as regards all Wild Birds extend annually between the 15th day of March and the 1st day of August."

In the discussion which followed, Mr. J. E. Harting, F.L.S., remarked that although in the recently passed "Wild Birds Protection Act, 1880," which repealed the three Acts of 1869, 1872, and 1876 an endeavour had been made to fix such a close time as would be most generally acceptable throughout the United Kingdom, it was quite possible that in some parts of the country a different close time would be more suitable. It was well known to naturalists that some species of birds begin to nest earlier in some counties than they do in others; and it was also well ascertained that certain species, like the Woodcock, whose protection during the breeding season was very desirable, were very early breeders. He had observed in certain districts that where owners of game preserves had given orders not to have the coverts disturbed after the 1st of February, Woodcocks had remained to breed. It was to meet cases of this kind that the close time fixed by the Act now in force had been made to commence early, usually from the 1st March to the 1st August. But he was quite prepared to hear that this was too early a commencement for some counties, and they had just learnt from Lieut.-Col. Russell's letter that in his opinion this was the case in the county of Essex. If so, the Act provided a remedy by enabling the Home Secretary, upon application of the Justices at

communicate with the Home Secretary in regard to the close time for wildfowl, with power to make any slight changes necessary to meet the views of the Home Secretary:—Messrs. C. P. Wood, E. N. Buxton, J. O. Parker, R. Woodhouse, T. C. Baring, M.P., J. Round, M.P., and Lieut.-Col. Russell; and it was further agreed, on the motion of Lieut.-Col. Russell, seconded by Major Tufnell-Tyrell, that, if thought advisable, the Committee be empowered to ask for a close time for all wild birds in the county from the 15th March to the 1st August. In a further letter, dated December 10th, Col. Russell remarks:—"I do not know whether I made it clear that we could probably get a change for *all birds* to 15th March and 1st August, and this would suit fairly well both birds and shooters; but it seems to me better to let all the birds have protection from 1st of March, except the few which perhaps once in several years give a chance in passing in March, such birds being worth shooting, and, as I am satisfied, will not have their numbers sensibly diminished by what are killed here, vastly greater numbers passing than can find accommodation or inducement to remain." Referring to the Wild Birds Act he adds: "I should have been glad to see *eggs* protected, but there are several objections, some of which were several years back well pointed out by Professor Newton—so I did not see my way to advise this. I suggested some limit of time being put to the sale of foreign fowl. This was not done, and if the killing or taking of migrants, as Widgeons, is stopped many weeks earlier than in Holland (1st April in one part, 15th April in another) so that our shops are full of Dutch birds, there will be great dissatisfaction and temptation to break the law, and many opportunities of doing so profitably, by passing off our few birds as Dutch. This is one great reason for extending the time of killing such birds."—Ed.

Quarter Sessions, to make an order extending or varying the close time. No doubt those sportsmen and naturalists who resided in Essex would be the best judges of the period which would be most suitable in their own county; and from what he knew of Col. Russell's capabilities and long experience in matters relating to wild-fowl, he felt sure that his proposed application to vary the close time would not be made without good reason.

The President was sure the Club was much obliged to Mr. Harting for his remarks; few naturalists had a better right to speak with authority on the subject, and he proposed that the Secretary be requested to write to Col. Russell with reference to this matter.

The Secretary thought that the great thing to be agitated for was a close time for ALL birds without exception. At present the Act was almost nugatory; it was simply impossible in most cases to prove legally that a Hedge-popper or Bird-catcher was trapping or murdering any particular species, and so a beneficent Act had become almost a dead-letter in the law.

Mr. English exhibited a large number of species of *Fungi*, both in a fresh and preserved state, belonging to the *Agaricini* and *Polypori* for the purpose of illustrating some remarks he had drawn up on the connecting links which united these two orders of the family *Hymenomycetes*. Among the species exhibited were *Polyporus fomentarius*, from which *Amadou* or German tinder is made, the fungus being cut into slices, dried and beaten until soft; *Polyporus lucidus* from Hornbeam, interesting as being a cosmopolitan species, and *Lenzites betulina* from Birch stumps. Mr. English exhibited also a specimen of *Osmylus chrysops*, L., a pretty insect belonging to the *Hemerobidae*, which had flown into his shop in August last. It is generally found amongst hedges, seeming to prefer stony rapid streams fringed with alders. Mr. Cole had taken it in New Forest, but had not observed it at Epping.

Mr. Argent exhibited, on behalf of Master G. Watkins, a specimen of *Vanessa antiopa* (the "Camberwell-beauty" butterfly), taken near Ilford during the last week in August.

Mr. W. C. Barnes exhibited some pieces of a felt-like substance which had been found closely covering some hot-water pipes in his house. It had every appearance of being the work of spiders.

The Secretary presented, on behalf of Sir J. Clarke Jervoise, Bart., a collection of *Mosses* and *Lichens* made by Richard Warner (1711-1775), author of "Plantæ Woodfordienses." He thought that the Club was much indebted to Sir J. C. Jervoise for another copy of the above-named work, and also for his kind present of the Herbarium. Although the latter was perhaps of no great scientific value, it was extremely interesting as a memento of an Essex worthy—a quiet "ingenious" country gentleman, who, at a time when botanical studies

were held in much less esteem than at present, did his best to aid forward the science which had afforded him such true and life-long delight. Mr. Cole read a paper he had drawn up giving as complete an account as the scanty materials would allow of Warner's life and "botanical amusements," and of the origin of the book by which he is best known.* Sir J. C. Jervoise had also sent up for the inspection of the members a quaint and valuable parchment Pedigree of the Warner Family.

Mr. Fisher Unwin exhibited a large number of views and drawings in illustration of persons and places mentioned by Warner. He thought as naturalists they might learn especially one thing from the interesting sketch of our author given by Mr. Cole, and that was to do the thing which came nearest to hand; study first the productions of their own neighbourhood, and let wider fields of work come as they may. He had been searching for the "Plantæ" for years, but had lately come upon quite a preserve of copies of the book, and had secured two or three enriched with curious notes. These he exhibited. One had belonged to the Rev. J. Shepard, Rector of Woodford, and a friend of Warner's. In it was a note of the dimensions in 1774 of the Yew-tree in Woodford Churchyard, and Mr. Unwin thought it would be well for the Club at one of its Field Meetings to visit the tree and take the dimensions now for the purpose of comparison. Another copy of the book contained a MS. list of plants growing in the neighbourhood of Chigwell, drawn up by the Rev. S. Palmer, of that place, as well as many other interesting notes of the plants of the Forest. Mr. Unwin's exhibits were a source of much pleasure to the meeting, interspersed as they were with short remarks upon the persons and places referred to.

Mr. George Spicer exhibited a view of the Old House in which Richard Warner lived, and copies of the same print were presented to the Club by Sir Clarke Jervoise.

The President thought it would be a good work for some of their botanical members to make a comparison of the list of plants now known to occur around Woodford, and those recorded by Warner. The question of the extinction of species is always one of great interest.

Cordial votes of thanks were accorded to Mr. English, Sir J. C. Jervoise, Mr. Cole, Mr. Unwin, and Mr. Harting, for their various communications.

Mr. J. Travis, of Saffron Walden, communicated the following list of rare birds taken in Essex, recently received by him for preservation:—

(1.) September 6th, 1878 (?). Dusky Petrel (*Puffinus obscurus*) found in the early morning after a very rough night, by the roadside

* The Editor reserves this paper for the present, at least, in the hope of obtaining further information of Warner and his scientific friends. Any particulars of this nature will be welcomed gladly.

at Sampford, by Barker, the Postman. It was apparently in a fatigued state, but lived two days in my (Mr. Travis's) possession, during which time it ate a few slugs, and sometimes used its hooked bill to assist it in climbing about the cage. The specimen was sold to Mr. Burrell, of Littlebury.

(2.) November 9th, 1879. Fulmar Petrel (*Procellaria glacialis*), taken by G. Pavitt, Esq., Battle's Bridge, near Chelmsford, and now in his possession.

(3.) December 5th, 1879. Great Bustard (*Otis tarda*), shot by Mr. Pertwee on what is called the "Main" near Chelmsford, and

(4.) February 6th, 1880. Another Bustard shot by the foreman to Mr. Jonas, Manor Farm, West Wickham, Cambridgeshire, and now in the latter's possession. Has any other naturalist within the last fifty years been so fortunate as to receive two English specimens of the Great Bustard within so short a period?

[These specimens are, of course, the birds referred to in Mr. Christy's paper, "Transactions," pp. 59 and 62.—ED.]

(5.) August 27th, 1880. A pair of Woodchat Shrikes (*Lanius auricularis*), shot by a man named Jeffrey, between Elmdon and Arksden. A boy driving sheep into Walden was accosted by Jeffrey, who had a gun. He gave the birds to the boy, remarking that they were "a pretty pair, and perhaps the bird-stuffer might give something for them." I received them within two hours of their death, quite fresh and hardly stiff. These are the first specimens of this very rare bird I have heard of as occurring in Essex.

(6.) , 1880. Peregrine Falcon (*Falco peregrinus*), taken by the gamekeeper to Squire Wilkes, of Lofts Hall, in whose possession it now is.

(7.) November, 1880. Peregrine Falcon, a young bird trapped by one of Lord Braybrooke's keepers at a moorhen, on which it had been feeding, near the Debden Road, Saffron Walden. Two other Peregrines killed in the neighbourhood are now in my hands.

(8.) 1880. Two Merlins (*Falco æsalon*), killed by Mr. Chipperfield, of Newport, near Saffron Walden.

(9.) November 1st, 1880. Two Black-throated Divers (*Colymbus arcticus*), taken at Southend, and now in the possession of Mrs. Ackland, of Saffron Walden.

(10.) November, 1880. Slavonian Grebe (*Podiceps auritus*), taken at Southend, and now in possession of Mrs. Ackland, Saffron Walden.

(11.) November 12th, 1880. Great Grey Shrike (*Lanius excubitor*), a good female specimen, shot by Mr. H. Rolfe, of Clavering, and now in his possession.

(12.) June 27th, 1879. A Lesser Redpole's nest (*Linota linaria*), taken by a boy named Rushforth out of some fir trees by the roadside close to Shortgrove Park. It contained young, which were brought to me,

and I have one of them yet—a very healthy bird, thanks to the care of Mrs. Travis. The boy had thrown away the nest, but described it as very much like a linnet's, but smaller.

Mr. Harting said he should like to make a few remarks on the above list. Many of the birds mentioned were of extreme rarity, and he thought it would be wise to ask for further particulars before giving the list a permanent place in the records of the Club. From experience he could say that in many cases it would be found on examining the evidences on which such lists were based that the writers have been too hasty in identifying their specimens with rare species. The very first bird on the list, to his mind, was very doubtful; the Dusky Petrel was of extreme rarity in Britain, and has only been obtained on one or two occasions; he could not help thinking that the bird referred to would prove to be a specimen of the *Manx Shearwater*; that bird breeds here, and it is often called a Petrel, although it differs from that genus in some respects. Of course it was quite possible that all the birds mentioned were correctly named, but he would strongly urge the necessity of caution and enquiry before accepting as absolute facts the statements made in such lists as the above.

The President thought all would agree with Mr. Harting in the necessity for caution: errors were easily committed and then became difficult to eradicate. He would suggest that the Secretary should communicate with Mr. Travis, with the view of settling the questions raised.

[The list was returned to Mr. Travis, who, we understand, is a good ornithologist, and it is now printed as revised by him.—ED.]

Mr. P. Copland exhibited some specimens of fossil wood from the London clay at Walton-on-the-Naze, and Mrs. Yeates some glacial drift fossils picked up in the neighbourhood of High Beech.

The meeting then resolved itself into a conversazione.

SATURDAY, DECEMBER 18TH, 1880.—ORDINARY MEETING.

The Monthly Meeting was held at the Head Quarters, at seven o'clock, the President in the chair. The following works were presented to the library: "Journal of Royal Microscopical Society," presented by W. Emmens, Esq., F.R.M.S.; "History and Description of Cassiobury Park" (folio), by John Britton, presented by Messrs. Alfred and G. H. Lockyer; "Deterioration of Oyster and Trawl Fisheries of England," by J. P. Hore and E. Jex, presented by the authors. The following persons were elected members of the Club:—Charles

Copland, C.E., H. C. Chilton, W. T. Christian, Sir J. Clarke Jervoise, Bart., and James Miller.

The Secretary gave notice, on behalf of the Council, that it was intended at the Annual General Meeting to propose some slight alterations in, and additions to, Rules III., IV., VII., and XV.

It was announced that, in accordance with Rule III., the following members would retire from the Council: H. B. Hooper, Rev. C. J. Ridgeway, C. E. Taylor, and T. J. Woodrow. The following members were recommended for election into the Council: B. G. Cole, Rev. T. W. Peile, Charles Thomas, F.G.S., and T. Fisher Unwin. No other candidates were proposed. As officers for 1881 the following members were recommended by the Council: *President*—Raphael Meldola, F.R.A.S., F.C.S., &c.; *Treasurer*—Henry J. Barnes; *Secretary*—William Cole; *Librarian*—Alfred Lockyer.

The President said that, by Rule XV., the Annual General Meeting should be held on the second Saturday in January, which would fall on January 8th. The Council was of opinion, however, that this would hardly allow time for the officers to prepare their statements, and therefore, with permission of the members, it was proposed to alter the date to January 22nd, and to confirm such alteration at the Annual Meeting. This was agreed to.

The Secretary exhibited, on behalf of Mr. John Waller, some sections of the common crab-apple (*Pyrus Malus*) with *Mistletoe* attached, showing the mode of growth of the parasite in the wood of the tree. These specimens were obtained at High Beech, Epping Forest, in 1876, by Mr. Waller, and were beautifully cut and polished. The specimens showed the root of the parasite forcing its way into the very heart of the wood, the pressure distorting the concentric rings and medullary rays of the apple tree in a very curious manner.

Mr. Meldola observed that there was a point in the life-history of the *Mistletoe* well worthy of consideration. It was well known that the glutinous seeds were deposited on the bark of the trees by birds, and it was stated on very good authority that in whatever position the seed might be placed with respect to the branch, the *radicle* (or embryo root) always turned towards the bark of the tree as development took place. He was disposed to think that the cause of this phenomenon lay in the avoidance of light; the *radicle* required shade for vigorous growth, and therefore it turned towards the bough of the tree to which the seed was attached. He would recommend it as a matter for experiment to their botanical members; it would lend a new and scientific interest to a plant which possessed, he understood, a peculiar charm at this season of the year.

Mr. H. J. Barnes exhibited, on behalf of his brother, some fossils found at Shanklin, Isle of Wight. They appeared to belong to the Lower Bagshot formation.

The Secretary called attention to the Second Science Lecture, which would be delivered in the Woodford Lecture Hall, on January 4th, by Mr. A. R. Wallace. He trusted that a large number of members would attend, and show their appreciation of a lecturer of Mr. Wallace's high scientific and literary reputation.

The usual conversazione closed the meeting.

TUESDAY, JANUARY 4TH, 1881.—SCIENCE LECTURE.

The second winter Science Lecture was delivered this evening by Alfred Russel Wallace, Esq., F.L.S., F.Z.S., &c.—subject, "The Natural History of Islands." The lecture took place in the Woodford Hall, Mr. Meldola occupying the chair and, in a few appropriate words, introduced Mr. Wallace. It is unnecessary to give any abstract of Mr. Wallace's very interesting and instructive remarks, as the subjects touched upon will be found fully elaborated in his "Island Life; or, The Phenomena and Causes of Insular Faunas and Floras, including a Revision and attempted Solution of the Problem of Geological Climates," London, 1881.

Before asking the audience to pass a vote of thanks to Mr. Wallace, the President invited questions on the subjects brought forward.

Mr. Harting, referring to the lecturer's remarks on the probable mode of the introduction of fresh-water fish into remote islands, suggested the following as worthy of consideration: That the heron, being a fish-eater and of rapid flight, might, after having seized its prey, travel a long distance and disgorge the fish in a living state in some island lake. It was a well-known fact that when disturbed these birds had the habit of freeing themselves of food; and he thought it was not unlikely that to such a cause may be owing some of the puzzling facts respecting the distribution of fishes mentioned by the lecturer.

Mr. Wallace said that the essential point to be decided was whether a fish, after being carried any considerable distance in such a way, could be disgorged alive, and asked Mr. Harting whether he knew of such an occurrence.

Mr. Harting gave one instance related to him by the falconer to the King of Holland; and he thought it not at all improbable that a fish could exist for some time in the gullet of the bird.

Andrew Johnston, Esq. (High Sheriff), proposed a hearty vote of thanks to the lecturer, which was passed by acclamation.

SATURDAY, JANUARY 22ND, 1881.—ORDINARY AND ANNUAL MEETINGS

In accordance with notice sent to all members, the Annual General Meeting was held at the Head Quarters, the President in the chair.

Previous to the Annual Meeting an Ordinary Meeting took place, when the following were elected members of the Club:—Mrs. Barnes, Rev. W. J. Bolton, M.A., Edward Brooke, J.P., D.L., &c., Lieut.-Col. Russell, J.P., D.L., &c., Samuel Smith, Frederick Stewart, J. G. Thomasin, Mrs. Thomasin, Rev. W. J. Wright, B.A.

The following books and magazines were presented to the library:—Gerarde's "*Herball, or General Historie of Plantes*," presented by Mr. J. Hutchison; "*Midland Naturalist*" (monthly), by Mr. A. Lockyer; "*Naturalist*" (monthly), by Mr. G. H. Lockyer; "*American Entomologist*" (monthly), by Mr. F. T. Lockyer; "*Flora of Essex County Mass.*" and "*Notes on Woody Plants of Essex County Mass.*," by the author, Mr. J. Robinson; Moffat's "*Insectorum sive Minimorum Animalium Theatrum*," &c., 1634, by Mr. B. G. Cole; "*Nature*" (weekly); "*The Cobham Journals*," and "*Synopsis Plantarum insulis Britannicis, &c.*," by Mr. W. Cole. By exchange:—"The Proceedings of the Boston Society of Natural History," Vol. XX., Parts 1, 2, and 3; and "*Report of South London Entomological Society for 1880.*"

It was also announced that the Rev. F. A. Walker, B.D., F.L.S., had presented to the Club his Collections of Birds, Birds'-eggs, and Insects, formed during the preparation of his "*History of Dry Drayton, London, 1876.*"

The thanks of the Society were unanimously voted for the above valuable donations.

The Secretary read a letter he had received from Mr. J. Eliot Howard, F.R.S., suggesting that the needs of insectivorous birds should be provided for during the hard weather by hanging a netted bag full of scraps of meat, suet, &c., from the bough of a tree or bush in some convenient place. Mr. Robarts remarked that he had adopted Mr. Howard's suggestion; the plan answered well, and the lively habits of the hungry little visitors afforded much pleasure.

The President said the Society was probably aware that the Council had passed a resolution as follows; that it had appeared in most of the influential London and county newspapers, and that the scheme of destruction was almost unanimously denounced by those whose opinion was entitled to weight. He read the resolution passed at the Meeting of the Council on January 8th:—

"That the Council of this Society, on behalf of the large section of the population of London interested in the pursuit of Natural History, desires to record an emphatic protest against the proposal of the Great Eastern Railway Company to carry a line across Epping Forest

believing that it is wholly unnecessary for the railway to take the route projected, and that it would not fail to prejudicially affect the advantages secured by the Epping Forest Act, which directs that the Forest is to be preserved as far as possible in its natural aspect."

The Club than resolved itself into the

ANNUAL GENERAL MEETING.

The Treasurer's Statement of Account (see page lxix) was read, and after some little discussion, was agreed to unanimously, on the motion of Mr. Letchford, seconded by Mr. J. Hutchison.

The Secretary read the REPORT OF THE COUNCIL FOR THE YEAR 1880:—

In presenting the first Annual Report, the Council feels that it can honestly and sincerely congratulate the members on the success which has attended the foundation and first year's work of the Club. It is unnecessary to recapitulate the steps taken in the formation of the Society; a short sketch of its origin has been prefixed to the Report of the Inaugural Meeting in the "Proceedings," and its subsequent progress is fresh in the minds of members. Within two months of the establishment of the Club, when the list of original members was closed, the number was 169; since that date 58 members have been elected. The Council regrets to record the loss of one member, Mr. G. Thompson, by death, already alluded to by the Chair; two members have resigned, so that our strength on December 31st was 224. It will be admitted that this forms a very gratifying token of the position the Society has already taken in public estimation, but your Council is sanguine enough to hope that it is but the precursor of further advance. The real backbone of a Society such as yours is the possession of a large body of enthusiastic members, and it cannot be too strongly urged upon all well-wishers that it should be their duty and pleasure to obtain additional recruits, and so add to the stability of the Club, and its power of accomplishing useful and permanent work.

In reviewing the events of the session, a first place must be given to the honour conferred upon the Society by the Duke of Connaught. The fact that his Royal Highness has both an official and personal interest in the County as Ranger of Epping Forest lends a peculiar appropriateness to his kind and ready acceptance of the office of Patron of the Club.

INCOME AND EXPENDITURE DURING THE YEAR ENDING 31ST DECEMBER, 1880.

Dr.			Cr.	
	£	s. d.	£	s. d.
To Subscriptions for 1880	..	91 2 6	By Books and Stationery	.. .. 13 13 0
" " 1881	..	6 18 0	" Printing Transactions	.. .. 35 18 6
" Life Compositions ..	..	36 15 0	" Miscellaneous Printing	.. .. 14 13 6
" Donations ..	..	3 13 0	" Expenses at Field Meetings	.. .. 39 2 5
" Sale of Publications	..	3 2 3	" Postages ..	.. .. 12 5 6
" Receipts at Field Meetings	..	39 1 6	" Advertisements	.. .. 4 11 4
" " Mr. Harting's Lecture	..	2 0 6	" Sundries ..	.. .. 2 13 4
			" Expenses of Science Lecture	.. .. 4 19 0
			" Balance in hand ..	.. .. 54 16 2
				£182 12 9

HENRY J. BARNES,
Treasurer.

Audited and found correct, { DAVID H. SAUL,
January 21st, 1881. { P. COPLAND.

The details of the establishment of the "Forest Camps Exploration Fund" will be found in the "Journal of Proceedings." The Treasurer reports that the sums given or promised up to January 1st amount to £44 3s. This sum will enable the Club to work at one Camp as soon as the weather is favourable in the spring, and in all probability the surplus will be sufficient to cover the cost of printing the results of the investigation in the "Transactions." It is very desirable that *both* Camps should be examined, and the Council solicits further subscriptions from members and others interested in the subject.

Eleven Ordinary Meetings of the Club have taken place during the year; 341 members have attended, giving an average of 31 for each meeting. Seventy-six visitors have also been present. At the seven Field Meetings held during the summer, 226 members have attended, giving an average of 32, with 106 visitors. Your Council is fully sensible of the great importance of interesting and instructive meetings; every effort will be made to maintain that character, and it is sincerely hoped and requested that members and friends will in all ways within their power aid such attempts. The Club is very much indebted to those gentlemen who so kindly acted as conductors at the Field Meetings. The Council also records with gratitude the pleasant hospitality accorded to the Club on its visit to High Laver Rectory by Mrs. and Mr. Rodwell.

Two parts of the "Transactions" have been published, in addition to the President's Inaugural Address, which comprises pp. 1-26, the whole occupying 154 pages. Part I. is occupied by Mr. Walker's lecture, a sheet of geological sections being given with it; whilst Part II. gives papers and full reports of meetings up to and including November 10th. The Council is painfully aware of the paucity of papers and communications submitted to the Club, but as this subject is dwelt upon elsewhere, it is unnecessary to do more than refer to it in this place.

A few books and publications have been presented to the Club during the year, which are duly acknowledged in the reports of the meetings, but the Library is necessarily at present in an embryonic stage. Pressure of other affairs obliged Mr. Argent to resign the office of Librarian in October, when the post was taken by Mr. Alfred Lockyer until the Annual Meeting. Mr. Lockyer offers his services as Librarian, and he has already been working energetically to establish friendly relations and exchange of publications with London and Provincial Societies. Two rooms at the Head Quarters will shortly be fitted up as a Library and Museum, and the Council earnestly begs members and others to aid with books and specimens. A special circular will be issued giving details as to the kind of specimens required, and best mode of preparing the same for our collections. Two contributions to the museum demand special notice: a small Herbarium

of lichens and mosses collected by Richard Warner, given to the Club by our member Sir J. Clarke Jervoise, Bart.; and the collections formed at Dry Drayton by our member Rev. F. A. Walker, B.D., F.L.S. These latter comprise small collections of birds, birds'-eggs, and insects, gathered in the preparation of the donor's "History of Dry Drayton, London, 1876."

The thanks of the Club are due to the Conductors of the Art Classes (Miss J. E. Cole and Mr. H. A. Cole) for permission to meet in the rooms at 3, St. John's Terrace, and the Council has great pleasure in accepting the offer of two rooms for the sole use of the Club's Library and Museum.

Bearing in mind the large amount of work involved in launching a Society such as ours, the members will probably consider the Treasurer's statement satisfactory. The Council records with thanks special donations towards expenses from Mr. Darwin, Mr. Walker, Mr. Letchford, and Mr. Browne.

In conclusion, your Council cannot but consider that the events of the year form an encouraging earnest of future work, and the officers confidently hope that they will not lack the energetic and enthusiastic support of members and friends during the year 1881.

The Report was carried unanimously, on the motion of Mr. B. G. Cole, seconded by Mr. Hutchison.

The Secretary proposed on behalf of the Council the following slight alterations in the Rules:—Rule III., to strike out the word "seven," and to read "*five to form a quorum.*" After Rule IV. to add "*should a vacancy occur in the Council by retirement or otherwise, the Council shall have power to nominate any member to fill the vacancy until the next General Meeting.*" In Rule VII. to add at end of first sentence, "*but shall not be entitled to receive the publications of the Club during the year without payment;*" and in Rule XV. to strike out in the first sentence the words "on the second Saturday," so as to read, "*The Annual General Meeting shall be held in January.*" These alterations were unanimously agreed to.

The members nominated at the meeting on December 18th were chosen to fill vacancies on the Council and as Officers for 1881.

On the proposal of the Council, the following gentlemen were elected HONORARY MEMBERS of the Club, in recognition of distinguished efforts for the advancement and spread of natural science, and in grateful acknowledgment of services rendered to the Club:—Dr. M. C. Cooke, M.A., A.L.S., J. E. Harting, F.L.S., F.Z.S., Worthington G. Smith, F.L.S., Major-General Pitt-Rivers, F.R.S., and Henry Walker, F.G.S.

The President then delivered his Annual Address ("Transactions," Vol. I., p. 97).

Mr. Robarts, in proposing that the address be printed and circulated in the usual way, said it was the future which should possess the most interest for them. It was very desirable that all members should strive to add their quota, however humble, to increasing the interest of the meetings, especially in objects and facts connected with the County. They ardently wished for a great increase in the number of members, not mainly to augment the funds, but that more matter in the way of original contributions might find its way into their hands. The resolution was seconded by Mr. Lockyer, and carried by acclamation.

Mr. Letchford proposed a hearty vote of thanks to the Officers of the Club in a humorous speech. Mr. Hutchison seconded, saying that few were aware of the large amount of work thrown upon officers of such Societies. The compliment was suitably acknowledged by Messrs. Meldola, Barnes, Cole, and Lockyer. Thanks were also voted to the Auditors; and on the motion of the President, seconded by the Treasurer, Miss J. E. Cole and Mr. H. A. Cole, the Conductors of the Government Art Classes, were warmly thanked for the accommodation afforded to the Club for its meetings, and the use of rooms for the Library and Museum.

INDEX

TO

JOURNAL OF PROCEEDINGS.

- Alga*, etc., observed at Field Meeting, xviii.
 Alterations in Rules, lxxi.
 Ancient Earthworks in Epping Forest, Proposed excavation of, xxxii, l, liv.
 ———, Visit to, xxiv.
 Annual General Meeting, lxxviii.
Aplecta occulta, xxii.
 Balance Sheet, 1880, lxix.
 " Botanical work to be done," xliii.
 Botany Class, Proposed, xi.
 Boulger, Prof. G. S., Abstract of Lecture, xliii.
 Brady, Sir Antonio, Abstracts of Addresses, xiii, xxxiii.
 Bustard in Essex, v.
 Club, Origin of, i.
 Connaught, H.R.H. The Duke of, as Patron, liv.
 Connection between the *Agaricini* and *Polyporei*, lxi.
 Cooke, Dr. M. C., Abstracts of Addresses, xviii, li.
 Cowper, B. H., Abstracts of Address, xxv, xxvii.
Daphne laureola, v, ix.
 Deer of Epping Forest, xlv.
Drosera rotundifolia, xxii.
 Dwarf *Lepidoptera*, xlv.
Ennomos angularia, xi.
Ephyra punctaria, x.
 Epping Forest and the Great Eastern Railway, lxxvii.
 Epping, Visit to, xix.
 Exchange Scheme, xxxiii.

- Field Meetings, viii, xvi, xix, xxiv, xxviii, xl, xlviii
 Food, influence of, on Insects, xi, xxxix.
 Foundation Meeting, ii.
Fungi, gathered at Field Meeting, xlix.
Fungi, rare, lv.
 'Fungus Meeting,' xlviii.
Galium aparine, sub-species *Vaillantii*, xxxii.
 Greensted Church, viii.
 Gynandromorphous Butterfly, xi.
 High Laver Church, ix.
 Honorary Members, iii, lxxi.
 Ilford, Visit to, xxviii.
 Insectivorous Birds in Winter, lxvii.
Lastrea oreopteris, xix, xxii.
Lepidium draba, xii.
Lepidoptera, Mortality among, xxxix,
 Library, Donations to, iv, v, x, lv, lix, lxliv, lxvii.
 Meldola, R., Abstracts of Addresses, vi, xxii, xlvi, lvi.
 Mistletoe, Growth of, lxv.
 Monk's Woods, Visit to, xvi.
 Mountain Buckler Fern, xxii.
 Museum, Donations to, lxi, lxvii.
 Officers and Council, 1880, iii; 1881, lxv.
 Ongar, Visit to, viii.
 Ordinary Meetings, iv, v, x, xii, xxi, xxxii, xxxviii, xlv, liv, lix,
 lxiv, lxvii.
Osmylus chrysops, lxi.
 Pitt-Rivers, Major-General, Abstract of Address, xxvi.
 Preliminary Circular, i,
 Protective Resemblance in Insects, xlvi lvi.
 Quail in Essex, xlv,
 Rare Birds in Essex, lxii.
 Report of Council, 1880, lxviii.
 Science Lectures, lvii, lxvi.
 Seasonal-dimorphism in Insects, x.
 Shrews, Mortality among, xlvi, lvii.
 Smith, W. G., Abstracts of Addresses, xxxvii, lii.
Spercheus emarginatus, vi.

Spurge Laurel, v, ix.
Stierha sacraria, vi.
 Sundew, xxii.
 Tea Fund, v, vii-
Thelephora multizonata, xlvi,
 Theydon Bois, Visit to, xl.
 Theydon Garnon Church, xlii.
Trichopteryx ambigua, vi
Vanessa antiopa, lxi.
 Vice-Presidents, iv.
 Walker, H., Abstracts of Addresses, xxi, xxx.
 Wallace, A. R., Abstract of Address, xxxiv.
 White Stoats, vi.
 Wild Birds' Protection Act, 1880, lix.

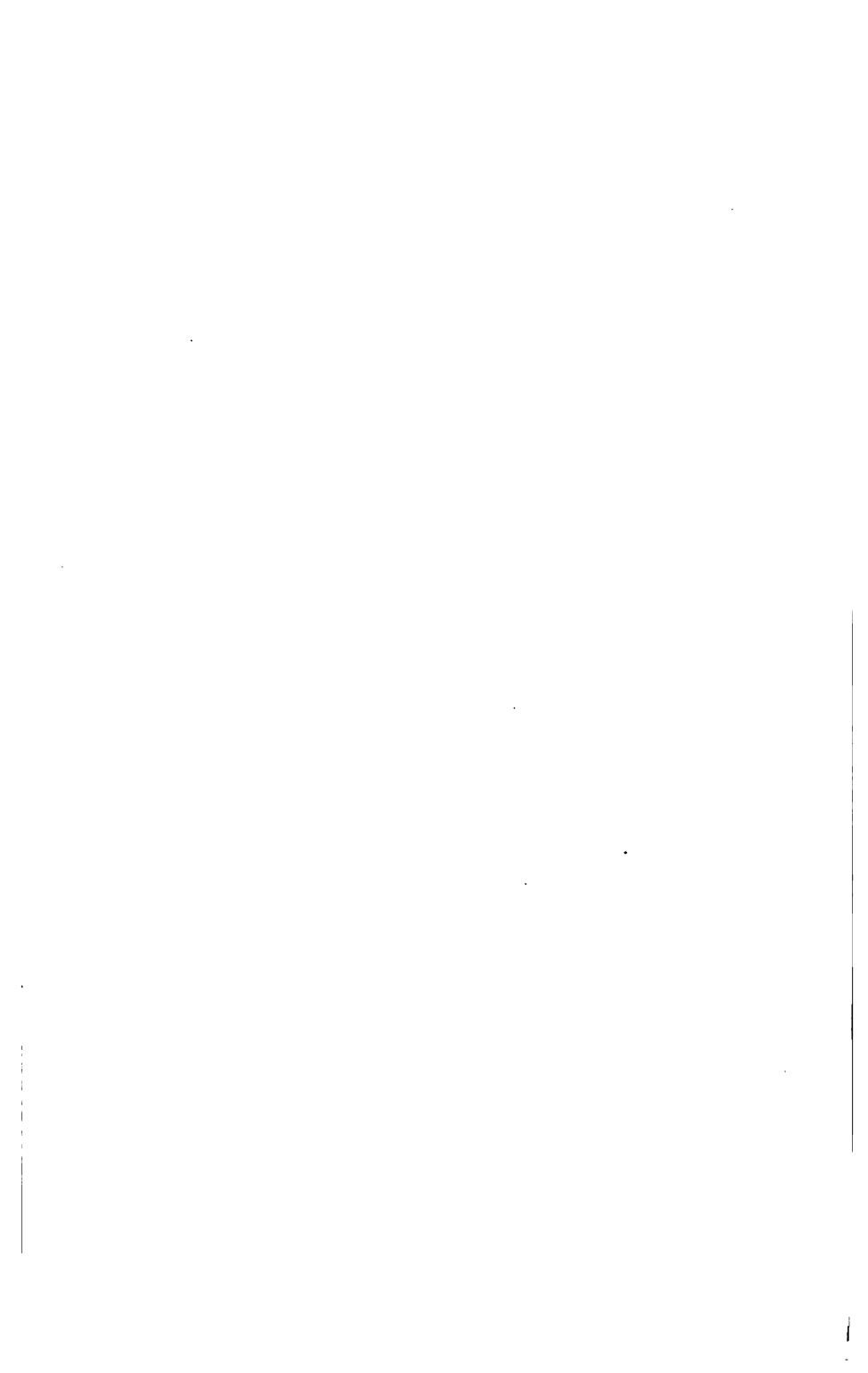
ERRATA.

P. 10	line 21	for <i>Woodfordiensis</i> read <i>Woodfordienses</i> .	
.. 20	.. 17	.. "	.. "
.. 26	.. 11	.. <i>radicosus</i>	.. <i>radicosus</i> .
.. "	.. 14	.. <i>alnicolor</i>	.. <i>alnicola</i>
.. "	.. 2 from bottom	<i>reptum</i>	.. <i>reptans</i> .
.. "	.. 3 do.	.. <i>ferum</i>	.. <i>puliferum</i>
.. ix	.. 18 & 20	.. <i>oderata</i>	.. <i>odorata</i> .
.. xi	.. 25	.. <i>weasels</i>	.. <i>stoats</i> .
.. xiv	.. 6	.. <i>omnes</i>	.. <i>omne</i> .
.. xlix	.. 19	.. <i>Bolkti</i>	.. <i>Boleti</i>

TRANSACTIONS
OF THE
EPPING FOREST AND COUNTY OF ESSEX
NATURALISTS' FIELD CLUB.

(ESSEX FIELD CLUB.)

VOL. II.



TRANSACTIONS
OF THE
EPPING FOREST & COUNTY OF ESSEX
NATURALISTS' FIELD CLUB.

(ESSEX FIELD CLUB.)

EDITED BY THE HONORARY SECRETARY.

VOLUME II.

FEBRUARY 26TH, 1881, TO JANUARY 28TH, 1882.

THE AUTHORS ONLY ARE RESPONSIBLE FOR THE STATEMENTS AND
OPINIONS CONTAINED IN THEIR RESPECTIVE PAPERS.

PUBLISHED BY THE CLUB,
BUCKHURST HILL, ESSEX.

—
1882.

LONDON :
PRINTED BY WEST, NEWMAN AND CO.,
HATTON GARDEN, E.C.

CONTENTS.

	PAGE
I. Is <i>Vanessa polychloros</i> the prototype of <i>V. Urticæ</i> ? A Query suggested by the Aberrant Form of a specimen of <i>V. Urticæ</i> of <i>polychloros</i> type. By WILLIAM WHITE. (With a woodcut.)	1
Discussion. By the PRESIDENT, and A. G. BUTLER, F.L.S., F.Z.S.	4
II. The Evolution of Fruits. By Prof. G. S. BOULGER, F.L.S., F.G.S.	8
III. The Blackwater Valley, Essex. By W. H. DALTON, F.G.S., of H. M. Geological Survey. (With a Plate.)	15
IV. The Developmental Characters of the Larvæ of the Noctuæ as determining the Position of that Group. By RAPHAEL MELDOLA, F.C.S., V.-P.E.S., &c. (With 2 woodcuts.) ..	19
V. Stone Implements from the Neighbourhood of Chelmsford, Essex. By HENRY CORDER. (With a Plate.)	29
VI. Note on some ancient Bronze Implements ("Socketed Celts") from the Neighbourhood of Little Baddow, Essex. By HENRY CORDER.....	31
VII. The First Night's "Sugaring" in England.—A Reminiscence of Epping Forest in 1843. By JAMES ENGLISH.	32
VIII. On the Formation of a Local Museum. By J. E. HARTING, F.L.S., F.Z.S., Member of the British Ornithologists' Union.	36
IX. Infusoria: What are they? Their Collection and Investigation. By W. SAVILLE KENT, F.L.S., F.Z.S., F.R.M.S.	44
X. Report on the Excavation of the Earthwork known as Ambresbury Banks, Epping Forest. By Major-General A. PITT-RIVERS, F.R.S., President of the Anthropological Institute. (With 3 Plates.)	55

	PAGE
XI. On the Origin and Distribution of the British Flora; with an Appendix on the River-basins of Essex as Natural-History Provinces. By Professor G. S. BOULEGER, F.L.S., F.G.S. (With a Plate.)	69
XII. On the Land and Fresh-water Mollusca of the District around Colchester: A Contribution towards a List of the Fauna of Essex. By HENRY LAVER, M.R.C.S., F.L.S. ..	88
XIII. The Galls of Essex: A Contribution to a List of the Insect Fauna of the County. By EDWARD A. FITCH, F.L.S., Secretary to the Entomological Society. (With 50 woodcuts.)	98
XIV. The Mammalia of Essex: A Contribution towards a List of the Fauna of the County. By HENRY LAVER, M.R.C.S., F.L.S.	157
XV. A Preliminary List of the Hymenomycetal Fungi of Epping Forest: A Contribution to the Botany of the County. By M. C. COOKE, M.A., LL.D., A.L.S., and JAMES L. ENGLISH.	181
XVI. The Presidential Address. Delivered by RAPHAEL MELDOLA, F.R.A.S., F.C.S., at the Annual Meeting, January 28th, 1882.	192
JOURNAL OF PROCEEDINGS at Ordinary, Field, and other Meetings.	i—lxxxviii
INDEX to Journal of Proceedings.	lxxxix
ERRATA.	xcii
APPENDIX.—Report of the Council and Balance Sheet for 1881, Catalogue of the Library, List of Members, &c.	

ILLUSTRATIONS.

PLATES.

	PAGE PAGE
I. Section of the Blackwater Valley, Essex.....	18
II. Stone Celt from the Neighbourhood of Chelmsford, Essex. ..	80
III. Plan of Ambresbury Banks, Epping Forest.	58
IV. Imaginary Section through Rampart of a Camp. Section through Rampart of Ambresbury Banks.	60
V. Fragments of Pottery found in the Rampart of Ambresbury Banks.	62
VI. Map of the Rivers of Essex, and the Natural-History Provinces based on them.	80
Sand-pipes in the Chalk at Grays Thurrook, Essex.	xiv

WOODCUTS.

	PAGE
<i>Vanessa Urticæ</i> of <i>polychloros</i> type.....	1
Structure of larvæ of Nocturæ and Geometræ	21
<i>Cecidomyia Ranunculi</i>	121
<i>Ceuthorhynchus sulcicolis</i>	122
<i>Cecidomyia Trifolii</i>	123
„ <i>Ulmariæ</i>	124
<i>Diastrophus Rubi</i>	124
<i>Rhodites Rosæ</i>	125
„ <i>Eglanteriæ</i>	125
„ <i>Rosarum</i>	125
<i>Cecidomyia Rosarum</i>	126
<i>Asphondylia Pimpinellæ</i>	126
<i>Hormomyia Millefolii</i>	127
<i>Urophora Cardui</i>	128

	PAGE
<i>Cecidomyia Veronicae</i>	129
„ <i>Bursaria</i>	129
<i>Aulax Glechomæ</i>	130
<i>Biorhiza aptera</i>	132
<i>Aphilothrix radialis</i>	133
„ <i>corticis</i>	133
„ <i>Sieboldii</i>	134
<i>Trigonaspis megaptera</i>	134
<i>Andricus noduli</i>	135
<i>Cynips Kollari</i>	135
<i>Aphilothrix gemmae</i>	136
„ <i>solitaria</i>	136
„ <i>globuli</i>	137
„ <i>autumnalis</i>	137
„ <i>collaris</i>	137
„ <i>callidoma</i>	138
„ <i>albopunctata</i>	138
<i>Andricus terminalis</i>	139
„ <i>inflator</i>	139
<i>Biorhiza renum</i>	140
<i>Andricus curvator</i>	140
<i>Dryophanta scutellaris</i> or <i>D. folii</i>	141
„ <i>divisa</i>	141
„ <i>agama</i>	141
<i>Neuroterus numismatis</i>	142
„ <i>lenticularis</i>	143
„ <i>fumipennis</i>	143
„ <i>læviusculus</i>	144
„ <i>ostreus</i>	144
<i>Spathogaster baccarum</i>	145
„ <i>tricolor</i>	145
„ <i>albipes</i>	145
„ <i>vesicatrix</i>	146
<i>Andricus ramuli</i>	146
„ <i>quadrilineatus</i>	147
<i>Nematus gallicola</i>	147
<i>Cecidomyia clausilia</i>	148
<i>Nematus viminalis</i>	149
<i>Cystidia of Coprinus aratus</i>	lxiv

JOURNAL OF PROCEEDINGS

AT

ORDINARY, FIELD, AND OTHER MEETINGS.

SATURDAY, FEBRUARY 26TH, 1881.—ORDINARY MEETING.

[BEFORE the commencement of the official business of the Meeting, the Rev. W. Linton Wilson, M.A. (one of the Vice-Presidents of the Club) in a kindly speech presented the Honorary Secretary with a handsome silver salver and a purse, on behalf of some members of the Club, as a friendly memento of his labours in the foundation and first year's work of the Society. The salver is inscribed as follows:—"Presented to William Cole, Esq., by some of the members of the Epping Forest and County of Essex Naturalists' Field Club, in recognition of his services in connection with that Society, February 26th, 1881." Mr. Cole in a short speech warmly thanked his friends and colleagues for their kindly feelings towards him, and for their generous appreciation of his efforts to found a Naturalists' Society in Essex which should be worthy of their fine but much-neglected county. He had received so much ready help from scientific and other friends that the work of calling the Club into being had been a very delightful task, and he felt that success was certain if equal energy and enthusiasm were shown in the future.]

The thirteenth Ordinary Meeting was held at the head-quarters of the Club, 8, St. John's Terrace, Buckhurst Hill, at seven o'clock, the President, Mr. Raphael Meldola, in the chair.

Letters of thanks for election as HONORARY MEMBERS from Dr. M. C. Cooke, J. E. Harting, Esq., Major-General Pitt-Rivers, Worthington Smith, Esq., and Henry Walker, Esq., were read by the Secretary.

Donations of books, pamphlets and periodicals (exclusive of "Exchanges") were announced from Miss Cole, Mr. B. G. Cole, Mr. P. F. Copland, Mr. W. H. Gomm (15 vols.), Mr. J. E. Harting (9 vols.), Mr. W. S. Simpson, Mr. W. Swanston, Mr. C. Thomas, Rev. F. A. Walker, and Mrs. Yeates. Mr. Heathfield presented one of Smith and Beck's "Universal Microscopes"; Mr. Gomm three exhibition boxes; the Rev. F. A. Walker some specimens of sponges, &c., from Hunstanton; and Mr. Meldola some skins of British birds. A vote of thanks to the donors was passed by acclamation. Upwards of twenty of the principal

Provincial Natural History Societies sent copies of their Transactions in exchange with the Club.

The following were elected members of the Club:—Messrs. C. Black, R. R. Hutchinson, B. Pratt, J. L. Reid, and A. H. Tozer.

The President informed the Meeting that, at the Council held that evening, the following gentlemen had been chosen as a Sub-committee to conduct the exploration of the Ancient Camps in Epping Forest:—The Officers, *ex officio*; Mr. D'Oyley (*Hon. Surveyor*), Mr. Thomas, Mr. Fisher Unwin, Mr. Roberts, and Rev. W. Linton Wilson. The Council requested the names of other members to act on the Committee; and Messrs. H. A. Cole, James English, and F. H. Varley were nominated so to act.

The Secretary exhibited, on behalf of the Rev. F. A. Walker, some specimens of "Petrified Oak" from the stone-quarries, Isle of Portland, and some large pieces of calcareous incrustations, or slabs of stalagmite, caused by the percolation of water over the surface of limestone rocks, and called by the guides "*congealed water*"; also from the Isle of Portland.

Professor Boulger remarked the idea that these slabs of stalagmite were really composed of hardened water was gravely held in many places. In the South of Ireland he had once pointed out some slabs to a limestone-burner, asking him why he did not put them into his kiln, as they would make excellent lime. From the man's replies it was evident he feared that the *congealed water* would put his fires out! (Laughter.)

Sir J. Clarke Jervoise sent up a plan of some earth-works in the Holt Wood, near Horndean, Hants, which he thought would be interesting in connection with the Forest Camps explorations. He also sent some pieces of flint, concerning which he wrote as follows:—"Near the camps in Holt Wood is a circular earth-work with high banks and a ditch; there is a pond in one part, pitched with flints, and on the mound and all about the sides of the pond the ground is strewn with reticulated 'Pot-boiler' flints (see Tylor's 'Early History of Mankind'). I happen to have specimens indoors, which I send. The late Mr. Albert Way gave me credit for being the first to discover the use of these flints, which have been heated and cooled rapidly in the operation of boiling food before earthenware that would stand the fire was discovered. We find them in heaps, generally near water. School-boys call them *milk-stones*. I once found a flint *cell* lying upon a heap of 'pot-boilers.'"

* "There is European evidence of the art of stone-boiling. . . . Moreover, the quantities of stones, evidently calcined, which are found buried in our own country, sometimes in the sites of ancient dwellings, give great probability to the inference which has been drawn from them, that they were used in cooking. It is true that their use may have been for baking in under-ground ovens, a practice found among races who are stone-boilers, and others who are not. But it is actually on record that the wild Irish, of about 1600, used to warm their milk for drinking with a stone first cast into the fire (J. Evans, in 'Archæologia,' vol. xli.)."—'Researches into the Early History of Mankind and the Development of Civilization,' by Edward B. Tylor, D.C.L., F.R.S. 3rd Ed. (1878), p. 268.—E.D.

Mr. Worthington Smith sent an original MS. description of two new species of *Agaricus* in the handwriting of Elias Fries, the great Swedish botanist. Mr. Smith wrote:—"As far as I know, the plant referred to in the first description has not been found elsewhere than in Epping Forest by myself. Fries, as you see, named the plant '*Agaricus (Stropharia) Worthingtonii*,' after me. The second description is the original one of a new species sent on by me to Fries. He named it '*Agaricus (Entoloma) Saundersii*,' after my friend Mr. W. Wilson Saunders, who lighted on it."

Prof. Boulger said he hoped the Club would carefully collect and preserve such relics. In his own researches into the history of Botany he had often found how useful it was to be enabled to identify a *hand-writing*.

Mr. English exhibited some flowers and leaves of plants beautifully preserved with their natural forms and colours by his process, which he had improved since his communications to the Club. Full details will be given in his book, now preparing for publication.

Mr. Letchford sent up a specimen of *Gordius aquaticus* to the Secretary for identification. He had found it whilst moving some damp earth in transplanting a rose-bush.*

Mr. W. Cole called attention to a letter from Dr. C. B. Bree, of Colchester, which appeared in the 'Standard' for January 28th, respecting the Hawfinch (*Coccothraustes vulgaris*) in Essex. After referring to the fact that the bird was more numerous this season than he ever remembered, Dr. Bree went on to say, "When first discovered in Epping Forest by the late Mr. Doubleday, the Hawfinch was pretty well confined to that locality as a breeding-place, at least so far as general knowledge went. Since then it has gradually come to breed all over the country. I have known it as a breeder in this neighbourhood for the last ten years. Ambrose, the local birdstuffer here, tells me he has had upwards of thirty this year. There are more than twenty now in his shop. He says they come from all parts of the neighbourhood. One boy caught seven in a garden near the river, and they can now be had alive. Naturalists will, I am happy to say, endorse my statements as to other parts of the kingdom. Unfortunately it is an easy bird to catch in bad weather." In a private letter to the Secretary, dated February 1st, Dr. Bree adds, "Henry Doubleday, of Epping, discovered this bird breeding there. It was not known generally, or there would not have been many left. As stated in my letter to the 'Standard,' I have known of its breeding near Colchester for the last ten years. It has occurred during the late severe weather in

* The *Gordiacea*, or hair-worms (sub-kingdom *Annuloida*), are parasitic in their earlier stages in the perivisceral cavities of the bodies of various insects. When sexually mature they leave their "hosts," and deposit their ova in water or moist earth. The popular name is expressive of their excessively elongated form, and as they are often found in water or in puddles after heavy rain, it is a vulgar notion in some parts that they are the living embodiments of *horse-hairs* which, falling into the water, have been, by a process of "abiogenesis," transformed into worms! Mr. Letchford's specimen was fully eight and a half inches long, and of the thickness of ordinary packing-thread. It lived for several weeks in a vessel of water.—ED.

all the villages round. It is a shy bird, and does not appear until forced by hunger."

Mr. English said that, in his opinion, the great habitat of the Hawfinch in Essex was Epping Forest. He had seen flocks of two hundred to three hundred at one time. They fed principally upon the seeds of the hornbeam (*Carpinus*), and in winters like the present, when hornbeam-seeds were scanty and the weather very severe, they spread over the country to villages and gardens in search of food.

Mr. H. J. Barnes said that a friend of his had a living specimen of the Hawfinch caught during the late frost, in Victoria Park, South Hackney.

Mr. W. White read a paper entitled, "Is *Vanessa polychloros* the prototype of *V. Urticæ*? A query suggested by the aberrant form of a specimen of *V. Urticæ* of *polychloros* type" [Transactions, ii., 1]. Mr. White exhibited specimens in illustration of his paper, and the President also brought up some British and foreign species of the genus *Vanessa*, for the purpose of emphasizing some critical and extended observations upon Mr. White's essay.

Professor Boulger gave a careful and lengthy exposition of his views on that difficult question, "The Evolution of *Fruita*" [Transactions, ii., 8], illustrating his observations by specimens and drawings on the black-board.

Hearty votes of thanks were passed to Mr. White and to Prof. Boulger for their communications.

At the Conversazione Mr. C. Oldham exhibited a series of crag-fossils from Walton-on-the-Naze, Essex, and a white aberration of the Hedge-Sparrow (*Accentor modularis*) from Wisbeach St. Mary's, Cambridgeshire.

SATURDAY, MARCH 26TH, 1881.—ORDINARY MEETING.

The fourteenth Ordinary Meeting was held at the head-quarters at seven o'clock, the President in the chair.

Donations of books and pamphlets (exclusive of exchanges with various Societies) were announced from Mr. B. G. Cole (2 vols.), Mr. W. H. Dalton, and Miss E. A. Ormerod, and thanks voted to the donors.

Mr. A. Lookyer announced that the Library and Museum had been furnished, and that various gifts and aid had been afforded by Messrs. P. Copland, A. Lookyer, and H. A. Cole.

The following persons were elected members of the Club:—G. H. Baxter, W. H. Bird, F. Cory, M.D., L.R.C.P., F.R.G.S., &c., A. G. Challis, W. H. Edinger, F. G. Harrison, Clermont Livingston, M.E.S., George Perry, Mrs. Perry, Henry Spring, and A. J. Yorston.

The President exhibited some specimens of the small destructive beetle, *Hylurgus piniperda*, which had been sent to him for identification. They had been confined in a glass tube fitted with a cork, and they had eaten their way out into the open air, completely destroying the cork.

The Rev. F. A. Walker, B.D., F.L.S., communicated two papers entitled, "Hunstanton and its neighbourhood in 1878" and "Hunstanton and its neighbourhood as visited in 1880." These were voluminous papers, giving details of the Architecture and Archæology of the village, with notes on the Natural History of the Coast, &c.

Mr. W. H. Dalton communicated a paper entitled, "The Blackwater Valley, Essex" [Transactions, ii., 15]. The paper was illustrated by the exhibition of a large coloured diagram, of which Plate I. is a reduced copy.

On the motion of Mr. Meldola a cordial vote of thanks was accorded to the authors.

The President then gave by word of mouth the exposition of his views with regard to the development of the *Noctua* embodied in his paper, "The Developmental Characters of the *Larvæ* of the *Noctua*, as determining the position of that Group" [Transactions, ii., 19]. The speaker demonstrated portions of his subject by means of drawings on the black-board, and Mr. W. White brought up for exhibition a fine collection of "preserved" specimens of caterpillars for the purpose of illustrating Mr. Meldola's remarks.

The Rev. W. Linton Wilson, in thanking Mr. Meldola, congratulated him on the method and perspicuity of his remarks, and hoped that the President's example might prove an incentive to others to bring before the Club the results of their studies and observations.

Mr. W. Cole also hoped that some of their entomological friends would follow the line of investigation so admirably sketched out by Mr. Meldola. He would caution intending observers that the earliest stages in the lives of caterpillars were often extremely transient. In many cases it would even be necessary to dissect out in glycerine the embryonic *larva* from the hatching egg, and examine with a low power of the microscope.

Mr. White said that the paper was highly suggestive of good work to be done by the earnest Lepidopterist in tracing out, with scientific methods and motives, the life-history of even the commonest and presumably the best-known species. He was convinced that most interesting facts would result from a series of careful observations, particularly if attention were directed to the very early forms of the caterpillars mentioned by Mr. Cole.

The President, in returning thanks for the kind reception of his paper, made some announcements of Field Meetings and other matters, and said he could not refrain from congratulating the Club and all who valued the integrity of their fine old Forest on the fact that the Great Eastern Railway Company had, in deference to public opinion very widely and strongly expressed, withdrawn the objectionable clauses relating to the projected line through the Forest from their Bill then before Parliament. (This announcement was greeted with loud and protracted cheering.)

The Hon. Secretary was very glad to say that most of the principal Natural History Societies in and around London had, at his suggestion, joined the Essex Field Club in protesting and petitioning against the

Railway; but the labour and credit of organizing the successful opposition to this atrocious Bill had in great measure fallen upon and belonged to their colleague, Mr. Francis George Heath, and he was sure the Club would accord that gentleman a very hearty vote of thanks for his spirited exertion in the cause. Mr. Fisher Unwin heartily seconded the motion, but warned lovers of the Forest that in all probability the snake was but scotched, not killed. Vandalism was evidently rampant in certain high places, and attempts to destroy the Forest would still be made.

The vote was unanimously passed, amid cheers.

At the *Conversazione* various fossils were exhibited (and presented to the Club) by Mr. A. Tozer; a very curious instance of *fasciation* in the common garden "Sweet-William" (*Dianthus*) was shown by Mr. Oldham. It had appeared two years running in plants in his garden at Woodford. Mr. Letchford showed under the microscope specimens of the fine Infusorian, *Bowerbankia imbricator*; and Mr. English brought up a case of specimens of preserved *Fungi*, intended for the forthcoming Fisheries Exhibition at Norwich. The collection comprised thirty-nine species, many of considerable rarity and interest. In view of the Club's visit to Waltham Abbey, Mr. Unwin exhibited his collection of views of the Abbey Church and Town. Mr. Waller, of Tottenham, sent specimens of mosses from Epping Forest, including *Dulcranum glaucum* in fruit, which he considered to be a rare event.

SATURDAY, APRIL 2ND, 1881.—FIELD MEETING.

In view of the doubtful quality of the weather to be anticipated at the early season of the year, it was decided to hold the first Field Meeting at Waltham Holy Cross, Mr. George H. Birch, M.R.I.B.A. (*Hon. Sec. to the London and Middlesex Archæological Society*) very kindly offering his valuable services as *cicerone* at the Abbey. The bulk of the members travelled by train from Liverpool Street Station to Waltham, others by road in a drag from Buckhurst Hill; and the united parties assembled at the Abbey-gates at about four o'clock, between seventy and eighty in number. The visitors were met at the Church by our learned Conductor, our members Dr. Priest and Mr. W. T. Wakefield, Rev. F. Johnstone, Mr. Churchwarden Gardener, Mr. W. Winters, F.R.H.S., and other local gentlemen. Much regret was expressed at the enforced absence, through illness, of the Rev. J. Francis, M.A., the Vicar, who had taken great interest in the proposed Meeting.

The company having assembled in the nave of the grand old building, Mr. Birch commenced a chatty description of the Church, explaining its architectural features and dwelling upon the historical memories still lingering around the fane of "Harold infelix"—our last English king. He pointed out that but a comparatively small fragment of the original had lasted to our times, but doubtless the part in which they then were

was of Harold's age. The Church built by Harold was consecrated about 1069; that was known to be the case because the names of the Archbishop and Bishops who attended the ceremony were all preserved, and the dates of their episcopates were known. Edward the Confessor and his Queen were also present at the consecration of the Church. From 1069 until 1177 no very great alteration took place in the Church; but at the latter date Henry the Second altered Harold's foundation altogether, by making it for monks instead of seculars. The large monastic buildings necessary for the accommodation of the abbot and monks which existed to the north of the Church were then erected; but he fancied that at that time there must have been some slight alteration made in the Church itself in regard to ornamentation—it occurred to him, from the existence of some chevrons, that they were then rather displeased with the baldness and plainness of some of the work and tried to improve it. It would be as well if those present would try to realise what the Church had been. It was just probable that in 1177 the original choir of Harold was extended farther to the east. Alluding to the Lady Chapel, Mr. Birch described it as a very beautiful little building, and said that the architectural work of the Chapel was almost unique in its sort; he knew very little work like that in England. Referring to other points in connection with the Church, Mr. Birch said that the existing tower at the west end was built in 1558. The baptismal font was the ancient one. It was composed of a beautiful block of Purbeck marble; but the shape had been altered, so that its present form was modern. Under Mr. Birch's guidance a thorough inspection of the Church was made, both inside and out. The only large tree in the churchyard is an Elm, supposed to be 300 or 400 years old; it measures 22 feet round the base, and 20 feet round the centre of the trunk, the height from the ground to the head being 12 feet; the main limbs were lopped off, but the tree is still living. The Abbey-grounds were visited, and on the north-east side of the churchyard, in Mr. King's garden, an ancient groined building called the "Potato Cellar," from its present ignoble use. Mr. Birch said in regard to this room that he did not think it was originally a chapel, as it ran from north to south; he thought that it was a portion of the Abbot's house or hospicium. As to the fact of the room being now unlighted by windows, there were traces of the wall having been disturbed, and it might very likely have been originally lighted by lancet windows; but Mr. Winters pointed out a ring which still remains in the centre of the groined ceiling, from which a lamp may have been suspended.

The Vicar had most kindly placed his private school-room at the disposal of the Council, and in it a kind of temporary Museum had been gathered together, chiefly by the exertions of Mr. Wakefield and Dr. Priest. The objects were very well displayed in the well-furnished room. Amongst other things Mr. Wakefield exhibited some coins found at Waltham Abbey; a series of 17th century tokens from Waltham, Colchester, and other Essex towns; seals, &c.; also a long and valuable series

of Greek, Roman and English coins ; a large selection from his collection of fossils ranging from the Silurian to the Newer Pliocene formations ; and a very massive microscope, made many years ago by Powell and Lealand, and presumed to be one of the two largest instruments in existence. The Rev. J. Francis showed some relics belonging to the Abbey, discovered at the time of its restoration in 1860 ; Dr. Priest some skulls and bones of Deer, Bison, &c., found, while digging the foundations of the New Powder Mills, in the peat-beds which extend over most of the marshes near the town ; they were exhumed from the depth of ten or twelve feet, a number of other bones and horns of Deer, &c., being found at the same time, which are now in the British Museum ; also a flint axe, and various drawings and engravings of the Abbey. Mr. Winters, F.R.H.S., brought up a copy of the foundation charter of the Church of Waltham, dated 1062, containing names of lordships and witnesses to the grant ; a representation of the great east window of the parish Church of St. Margaret's in Westminster, which window was removed from Waltham Abbey at the time of the dissolution ; autograph of Dr. T. Fuller, author of 'Church History' and 'History of Waltham Abbey,' who was a Vicar of the place ; facsimile of the Domesday Book, and deeds relating to Waltham. Mr. Fisher Unwin exhibited a large number of interesting plates and drawings of Waltham Abbey and the Eleanor Cross at Waltham Cross, and some old county histories ; Mr. Walter Crouch a series of prints illustrating the architectural details of the Abbey, and the ancient market stocks ; Mr. Corder some flint implements found near Chelmsford. Other objects were shown, and, all being carefully labelled and explained by Dr. Priest and Mr. Wakefield, the whole formed a very interesting collection.

The members and major portion of the visitors sat down to "high tea" at the "Cock Inn," excellently served by Mr. and Mrs. Giles. After tea a meeting was held in the "temporary Museum," the President occupying the chair. He expressed his pleasure in bidding welcome, on the part of the Council, to those present at that their first Field Meeting of the season, and hoped it would be the first of a series of equally successful meetings and a good omen of the future (Applause). The Chairman then introduced Mr. Birch, who gave some further details concerning the Abbey Church, commencing his paper by observing that, in the present age, facts which had been believed in for generations were subjected to searching criticism, to discover flaws and to raise doubts. It was not his intention to raise any doubts then. He would ask them to accept as a fact that Harold really lived and was buried at Waltham Abbey, and by thus begging the question he would dispose of a quantity of matter with which they had little to do in describing the building in question, which was anciently known to pious worshippers as the Church of the Holy Cross at Waltham. Harold was not the real founder of this famous Abbey. To discover who that founder was, we must transport ourselves to a good half century previous to Harold's time. About the year 1000 there was a great religious enthusiasm. That year was devoutly

believed to be the end of the world, and the last swell of that great wave of enthusiasm had not entirely subsided when the miraculous cross which was brought to Waltham and deposited in the church erected there was discovered. It was a miracle-working age, and no wonder that a miraculous crucifix was found under-ground, possessing extraordinary virtues, and demanding extraordinary devotion on the part of the faithful. Tovi, who lived in the time of King Canute, was the first to set aside a portion of his land for the purpose of building a church at Waltham. After Tovi's death the lordship of Waltham seemed to have reverted to the Crown, and subsequently Harold enlarged Tovi's foundation for two priests to one for a dean and twelve canons. The regular clergy or the monks had not then attained the footing in England which they afterwards did. We did not during several succeeding reigns hear of any alteration in Harold's Church, which was consecrated in 1059. The founder himself had been found under a heap of slain, and had been laid to rest in the choir of his own Church. A wonderful tale of how Harold had escaped, and had had several subsequent adventures and admitted that he was Harold, had been invented; but that legend could not bear the test of historic research. In the year 1177 an important change took place at the church at Waltham, when Henry the Second enlarged Harold's original foundation. Henry's work was probably limited to the choir, of which nothing now remains, and to the conventual buildings, of which fragments do remain. In 1242, in the time of Henry the Third, we hear of the Abbey Church of Waltham being consecrated, proving that some alteration had been made in the east end of the Church; that the altar had been moved, thus causing the choir to require re-consecration. There is thus very little doubt that Harold's choir had been pulled down, and a more magnificent choir built. He believed that, in making excavations at the east end of the present Church, foundations were discovered on the north side for a long distance in a line with the present walls, proving that the choir was a very long one, probably nearly the same length as the nave. There was found no wall on the south side to correspond with that found on the north side; the foundations on the south side had been entirely removed. Afterwards a beautiful Lady Chapel was built on the north side of the nave. From the character of the work of the Chapel, one would imagine that it was early 14th century; but he thought that it was a little later than that, and dated from about 1340. No alteration of any magnitude was subsequently made until the dissolution, after which time as much trouble was taken to demolish as had previously been taken to build. During the reign of Philip and Mary the central tower was blown up with gunpowder. In the 18th century and early in the present all sorts of barbarities were inflicted on the Church, the roof being lowered and two galleries erected at the west end, and the whole area filled with high pews. The present improved state of the Church was due to the work of Mr. Burges, the Architect of the restoration in 1859—60. A few fragments of the domestic buildings of the Abbey even now existed.

There was on the side of the Lea a fine pointed archway, built of masonry largely repaired with red bricks. He believed that in the beginning of the present century a good deal more of that gateway existed; some of it fell. The old Abbey-walls extended for a considerable distance, and a few of those present, he dared say, went into that beautiful little building now called the potato-house. That, as far as he could make out, must have been a portion of the Abbot's house, guest house, or hospicium. Even in its present degraded and dilapidated condition, it was a beautiful specimen of ancient monastic buildings. The destruction of the central tower of the Church of course necessitated the erection of another for the bells, and in 1556 the present tower at the west end was built. He would just say, in regard to Harold, that good men's deeds lived after them, and the massive walls of the Church which Harold had erected remained to test the fact of the survival of the good; and good it was, though there might be a difference of opinion in these days as to the utility of a religious foundation. Harold's name was a memory dear to many, and would be so as long as bravery was held in good repute and misfortunes were pitied. (Applause.)

A considerable discussion arose on some points touched upon in Mr. Birch's paper, in which Rev. W. Linton Wilson, Mr. Godwin, Mr. Roberts, Mr. Fisher Unwin, and Mr. Friswell took part. In replying to these questions and observations, Mr. Birch said there were no remains whatever of Earl Tovi's Church, which was founded about A.D. 1000, and which must have been very small, as the foundation was for only two priests. As to the date of the bridge, which lies a little to the north of the Church and which had been regarded as of contemporary date, he thought it must have been built about the 15th century, as it had a four-centred arch, which did not appear in England till about that time. With regard to the pillars being decorated with spiral lines and chevrons, the description of Harold's Church spoke of Harold adorning his building with plates of metal gilt, and Dr. Freeman as well as Fuller had fancied that brass must have been let into those flutings. All who knew anything at all about bras knew that it was not malleable, like lead; it had to be cast, and therefore brass could never have been put into those chevrons and flutings. However, in making an examination of the pillars that day, he (Mr. Birch) had noticed marks of rivets, and it certainly occurred to him at the time that Dr. Freeman was not after all so very far wrong. The question was, whether some copper-gilt or other metal might not have been so inserted. As to the stone of which the Church was constructed, he thought it was Carnac, and there would be no difficulty in accounting for its transportation to Waltham—it was probably brought up the Thames and the Lea. It was not Caen stone, which was not introduced into England until a later period.

A very hearty vote of thanks was passed to Mr. Birch for his valuable dissertation and the assistance given during the meeting; also to the Rev. J. Francis for the use of the room, and to Dr. Priest and Mr. Wakefield

for their exertions, on which the success of the meeting had so much depended. After a short *Conversazione*, the members made their way home, in companies, some by rail, some by road; whilst a select band chose rather a walk across the valley, and through the Forest to Buckhurst Hill, Woodford, and Chigwell.

SATURDAY, APRIL 30TH, 1881.—ORDINARY MEETING.

The fifteenth Ordinary Meeting was held at the head-quarters at 7 o'clock, the President in the chair.

Donations of books, pamphlets, and periodicals, &c. (exclusive of "Exchanges") were announced from Mr. B. G. Cole (2 vols.), Mr. W. Cole (16 vols. and numerous pamphlets, &c.), Mr. P. Copland (9 vols., with the 'Zoologist' and 'Journal of Botany,' monthly), Edinburgh Geological Society (3 vols.), Mr. G. S. Gibson, Mr. J. E. Harting (3 vols.), Mr. A. Lockyer (3 vols.), Mr. G. H. Lockyer, Mr. F. T. Lockyer, and Mr. W. White (pamphlet and map). A unanimous vote of thanks to the donors was passed.

The following gentlemen were elected members of the club:—Charles A. B. Brooker, Henry Bliss, Frederick W. Cory, M.R.C.S., F.M.S., &c., John Chambers, M.R.C.S., &c., Rev. Albert Hughes, M.A., Thomas King, J. W. Lawson, G. C. Locket, Rev. A. Gray Maitland, F.R.G.S., Benjamin Newling, M. Whiteley Williams, F.C.S., F.I.C.

On the motion of the Secretary, it was agreed that Mr. James Fletcher, President of the Ottawa Field Naturalists' Club, who was about to visit England, should be admitted to the full privileges of membership during his stay in this country.

The Secretary said that Mr. W. H. Dalton, F.G.S., had asked him whether any member could record *Cyclostoma elegans* as now living in Essex. Mr. Dalton wrote:—"I have found it, and so has Mr. Christy, abundantly in very modern alluvium and spring-peat, but never living, and I fear it is extinct. Query, from what cause. . . . I have found *Cyclostoma* in peaty alluvium at Rivenhall (Witham, Essex), and Wormingford (Nayland, Suffolk); and Mr. Rowe, of Felsted, sent me a very recent looking specimen from surface-soil there, but I never could hear of it living in Essex. The chalky boulder-clay is quite calcareous enough for it, but there may have been some slight alteration of environment to extinguish it lately. *Achatina acicula*, supposed to be rare, is very common in South Essex. A good habitat for the dead shells (*Hibernice dictu*!) being ant-hills in grass-land (*Formica flava* or *rufa*). The same heap should be looked over frequently, as the shells are worked out by rain to the surface."

Mr. Walter Crouch (who brought up some fine specimens of *Cyclostoma* for exhibition), said he had never found the shell in Essex either living or dead, nor had he heard of specimens being found in the county. It

was a well-known species, common on chalky soils, and he had seen it in Kent, Sussex, Surrey, Wiltshire, and on the limestone in Derbyshire, &c. It evidently prefers, and most likely requires, chalk or lime for its operations. He suggested that search should be made at Purfleet or Grays, on the chalk, for the mollusc.

The President said it was clear from Mr. Dalton's and Mr. Christy's observations that *Cyclostoma* had once lived in Essex, possibly finding suitable conditions in the chalky boulder-clay; and he suggested the possibility that the disappearance of the species was due to the removal of the chalky clay by superficial denudation and other causes.

Mr. H. J. Barnes exhibited some shells of a species of *Ostræa* found in large quantities in digging a new sewer at Leyton at a distance of about twenty feet from the surface.

Mr. H. Corder exhibited, and read some notes on, three Neolithic Implements from the neighbourhood of Chelmsford [Trans. ii. 29.] He also exhibited and explained some ancient Bronze Implements ("Socketed Celts"), found two years ago in a field near Little Baddow, Essex [Trans. ii. 31], and some bones of Pleistocene *Mammalia* from the brick-earth, Chelmsford.

Mr. James English read a paper entitled "The First Night's 'Sugaring' in England: a reminiscence of Epping Forest in 1848" [Trans. ii. 32.]

Mr. Meldola said he was sure Lepidopterists would read with pleasure Mr. English's chatty account of the earliest application of a process to which they owe a revolution in the extent and beauty of their collections. One interesting fact appeared to be clearly established by the use of the method of "sugaring," and that was the possession of an organ of smell by Lepidoptera and other insects. He suggested that it would be an important experiment to remove the antennæ of moths, and see if they found their way to "sugar" when thus mutilated. In the course of conversation Mr. English expressed his belief that moths would not come freely to sugar when the trees were infected with honey-dew, and that the circumstance explains one at least of the causes of the uncertainty of sugaring as a mode of collecting.

A unanimous vote of thanks was passed to the authors for their papers.

At the Conversazione Mr. J. S. Morten exhibited, under the microscope, some specimens of parasites belonging to the genera *Argas*, *Trichodectes*, and *Hæmatopinus*; Mr. J. D. Cooper two Flint Spear-heads and a Knife from the Ancient Indian Burial Mounds near Belize, Central America; and Mr. W. Cole a series of *Noctuæ* for the purpose of illustrating Mr. English's paper.

SATURDAY, MAY 14TH, 1881.—FIELD MEETING.

EXCURSION TO GRAYS THURROCK, ESSEX. CONDUCTORS: PROFESSOR JOHN MORRIS, M.A., F.G.S., AND HENRY WALKER, ESQ., F.G.S.

[For the Geological portions of this report the Editor is indebted to the kindness of Mr. Walker, who supplied the admirable résumé embodied in the following pages.]

This being an excursion in conjunction with the Geologists' Association, the members of the two Societies assembled in very considerable numbers, leaving Fenchurch Street Station by the 2.25 p.m. train. The route for almost the entire distance lies across the gravel and alluvial flats of the Thames Valley. The wide and shallow tributary valleys of the Lea and the Roding, as they were successively passed, were well seen. During the remainder of the journey the nearer features southwards are the *levées* confining the River Thames within its modern artificial channel, whilst beyond is seen the bold and natural horizon formed by the chain of hills stretching from Greenwich to Erith, the southern limit of the valley along that line. On nearing Purfleet, the western outcrop of the small area of chalk which is found in South Essex begins to be visible. On nearing the station, and looking to the left-hand side of the railway, an old chalk-pit, abandoned now to the botanist and entomologist, reveals both the chalk and the Thanet sand, the latter capping an isolated mass of the former. Past the station the bare sides of the great conical mound of Thanet sand, having a high angle of rest, and being a very conspicuous object from the Erith side of the river, is close at hand. The remaining three or four miles of the journey lie along the West Thurrock Marshes, but on the left the presence of the chalk skirting the railway is told by its characteristic contours.

Alighting at Grays, the party received some notable reinforcements, and the united forces, considerably exceeding one hundred in number, were conducted by Mr. Walker to the high road leading to Stifford. Here the extent and position of the three southern chalk-pits are well seen; the East Pit; the Central Pit (appropriated for the manufacture of whitening); and the Western Pit, occupied by the South Essex Waterworks Company. Attention was called to the flooded condition of the Eastern Pit, the floor having been worked down to the level of the springs, and the pumping being temporarily suspended. The sides show the green-tinted bed lying on the surface of the chalk, and the Thanet sand above. The islands below, overgrown at the surface with vegetation, but revealing on their bare sides a sharp dip of their component strata, were here the subject of some cautionary remarks; their real character as spoil-heaps, or "tips" of Thanet sand and gravel, has not always been recognised, even by geological visitors. A descent to the central pit was then commenced. On the way one of the Greywethers or Sarsen-stones, for which Grays has long been notable, was found lying on the unworked surface of the chalk, at a spot

where the Thanet sand had been breached, and was the subject of an exposition from Professor Morris. Its surface showed the mammillated appearance so frequently found in these concretions. (Some very large and characteristic examples are to be seen in the adjacent village, near the wharf of the Grays Chalk Quarries Company.) The Professor pointed out that these rounded appearances were not due to the wear and tear of transport. A thin flake examined by the microscope would show the sandstone to be composed of subangular quartz grains, and not of these grains rounded. Looking at the range of the Bagshot and Thanet sands, which at one time extended all over the valley of the Thames, he was inclined to consider these Greywethers as derived from the indurated base of the latter; the softer sand had been carried away by denudation.

On reaching the floor of the pit, which is excavated one hundred feet into the chalk, the party examined the fine vertical sections which are there exposed, consisting of upper chalk, with green-flint bed, Thanet sand (in some places twenty-five feet in thickness), and High Terrace Thames Valley drift. Some of the "sand-pipes" here are sixty and seventy feet in depth, partially filled, in some instances, with gravel, and in others with Thanet sand. Sir Antonio Brady, who was present, called attention to one of the more remarkable, which had penetrated below a horizontal band of flint without disturbing it. Mr. Walker gave a general account of the structure and composition of the rocks here exposed; the chalk, with its marine organic remains, more especially its sponges, corals, "sea-urchins," mollusca and fishes (a large number of the curious palatal teeth of *Ptychodus* and other sharks were shown subsequently); the Thanet sand, marine but unfossiliferous, near London; and the "High Terrace Thames Drift" of Professor Prestwich and Mr. Whitaker (the "Marine Gravel" of Mr. Searles Wood). Prof. Morris followed with a comprehensive review of the history and former range of the chalk, Thanet sand, and other Eocene beds now missing below the gravel, especially descanting upon the great physical changes which had taken place in the face of Europe (such as the elevation of the Alps), in the interval denoted by the absence of the Woolwich beds, Oldhaven pebbles, London clay, and Bagshot sand. Referring to the Green-flint bed (the "Bull-head bed" of the workmen), Professor Morris called attention to the well-marked concentric structure of many of the flints, probably owing to the presence of iron, which tends to this arrangement. The solvent action of carbonated waters, which formed the "pipes," was also seen, the Professor said, in the undulating surface of the chalk, as traced by the course of the green-flints. The depressions in this line were therefore posterior to the elevation and desiccation of the sea-bed. With regard to the absence of Woolwich beds and London tertiaries which once overlay the Thanet sands, he pointed out that the Woolwich beds were found about a mile further inland, at the village of Stifford, and he would suggest to the Essex Field Club an examination of them at that spot, inasmuch as the only instance of a certain shell of the Woolwich

and Reading beds obtained north of the Thames had been found there. He thought the Club might do good service to geology by carefully investigating the strata referred to at Stifford.

At the conclusion of Professor Morris's remarks Mr. J. Spiller, F.C.S. (Treasurer of the Photographical Society), took a photograph of the group, and also obtained some negatives of the sections exposed in the workings. A print from one of these, produced by the Autotype Company, is given as a plate* accompanying this report. The photograph shows one of the larger "pipes" in the chalk at Grays. The view is in the South Central Chalk-pit, and the "pipe" is seen in shadow in the left foreground of the picture—a wide and irregular-shaped cavity traceable down to the floor of the pit, a distance of more than ninety feet vertical, and containing deposits from the overlying Thanet sand and high-level drift gravel.

Other "pipes," in a less advanced stage of erosion, are shown in the centre and to the right of the picture.

The abandoned Western Pit, in which the South Essex Water Company obtain their supply, was then visited. In the engine-house Mr. Walker stated that, in 1860, the chalk had been worked to the level of the springs in this pit over an area of some sixty-five acres, when attempts to go deeper led to the discovery of an abundant supply of pure water and the formation of the Company. The water passing over the gauge every twenty-four hours was found to exceed 1,200,000 gallons, and even with five engines at work it became necessary to brick-up fissures, so as to keep the water down. Mr. Prestwich, in accounting for this volume of water in an area where the superficial pervious beds do not exceed five miles in extent, extends the receiving ground to the area of the Kentish chalk, as well as to the northern chalk area which begins beyond Bishop's Stortford and Dunmow; considering that the Thames, which opposite Greenhithe and Dartford is not, even at high tide, more than fifty or sixty feet in depth, would not intercept all the springs.† The daily quantity now yielded is about 1,300,000 gallons, of which 600,000 gallons is pumped to waste to avert inundation. Owing to the low level to which the chalk has been worked, the water is found near the surface, the engine-house floor being seventeen feet above Ordnance datum, and the water in the well varying from that line to eight feet below it.

This old chalk-pit would seem to be a capital hunting-ground for both entomologists and botanists. There is plenty of undergrowth and chalk-loving plants, the *Clematis vitalba* being notably luxuriant; but the claims of the geologists were so imperative that no time was allowed for herborizing. In the sections of the Thanet sand an abundance of the

* Our members will be pleased to learn that we owe this interesting and instructive record of a pleasant meeting to the kindness of the three following gentlemen, who reimbursed our Treasurer for the cost of the plate in the manner following:—Mr. Meldola, £2 2s.; Mr. John Spiller, £1 1s.; and Mr. Harcourt, 10s.—Ed.

† 'Report of Water-springs at Grays.' Privately printed, 1860.

burrows of Fossorial Hymenoptera were noticed, and Mr. W. F. Gwinnell gathered from the *Artemisia vulgaris* (mugwort), growing on a large ballast-heap to the north of the engine-house, a reddish gall, which eventually turned out to be new to Britain. [See Proceedings, May 28th.]

The steep ascent to the high ground between the northern and southern pits was then commenced. At the summit a wide view of the landscape and its geological features, especially southwards over the Thames, is obtained. The character and origin of the scenery was described with much eloquence by Professor Morris. On the north was seen Laindon Hill (388 feet), where the Bagshot sand caps the London clay; the Tertiaries covering the country as far as the eye could reach. At the same elevation, on the opposite side of the Thames, a widely different development of the rocks was seen. Owing to the continued uprise of the beds towards the Weald, the chalk, which on the Essex side of the valley is brought to the surface by an arch limited to the Thames Valley, soon becomes in Kent the surface rock of the district, rising at Knockholt to 780 feet. From the height at Grays, the wooded Tertiary outliers which diversify the comparatively treeless chalk country were pointed out; Swanscombe, with its capping of London clay, and Cobham Mount, capped with Oldhaven pebbles, being prominent examples. The geological causes of the survival of some of the older features of the country and the destruction of others were instructively described by Prof. Morris; and with this exposition the afternoon's pleasant series of sermons in stones may be said to have terminated. Prof. Morris had to leave for town, and Mr. Walker gracefully expressed, on behalf of all present, the great pleasure and profit they had derived from his teachings in the field that afternoon.

It was found to be impossible to carry out the intention of visiting the brick-earth beds at Little Thurrock ("Globe Cement Company's Works," permission to visit which had been kindly given by C. J. Mander, Esq.); and shortly afterwards the members of the Club, with many of the Geologists' Association, including the genial Secretary, Dr. Foulerton, F.G.S., wended their way back to Grays, and sat down to tea at the "King's Arms Hotel," served in capital style by Mr. Cuming; albeit there was not room for all at the Inn, and many had to seek accommodation elsewhere.

The President afterwards said that he thought such a juvenile Association as theirs might congratulate itself upon having been associated with such a veteran body as the Geologists' Association. He was rather glad that they had not been able to carry out their full programme, because this might serve for an excuse for joining again with the Association to finish off the beds at Little Thurrock. (Cheers.) Their thanks had been expressed to the veteran geologist who had left (Professor Morris), and it was now his pleasant duty to express their thanks to their worthy conductor, Mr. Walker, for his admirably-rendered services. He very much regretted that time had left them with only a very few moments

to attempt anything in the way of discussion. Many geologists had left, but he saw they had with them Sir Antonio Brady. He was afraid, however, that it was too late for any real discussion.

Mr. Walker, in replying, said he wished to mention one or two facts which had not yet come under their notice. The reference to the Geologists' Association in connection with the Essex Club was very satisfactory to him; he was an early member of the Association, and was always glad to bear testimony to the work which it had done, especially as it was one of the oldest of the London amateur Natural History Societies—older even than the Quekett Club, for which precedence had been claimed. None of them who met for out-door work in Natural History could be ignorant of the great work of propagandism which was carried on by the Geologists' Association. He was exceedingly glad of the muster that day, because in these days the interdependence of the sciences had gained such a recognition that no man could safely restrict his enquiries to one branch. Therefore it was desirable that the faunists and others who were not geologists should become so as soon as possible. And as their excursions took them some twenty or thirty miles out of town at a time, it was economy of time and opportunity to observe in more than one department of Natural Science. In the field that day they could pursue Entomology, and they could find many interesting plants, as well as study Geology. He apologised for the curtailment of the programme, and stated that he had been down there twice rehearsing the excursion. He had been all over the fields at Little Thurrock, and had found there about twelve feet of false-bedded sands, the most beautiful example of that phenomenon near London; he thought that it beat even that at Finchley. There they saw stereotyped in permanent form what was going on in the Thames to-day—shallow-water deposits pitched down at a low angle, and then denuded subsequently. They would have a very good chance at Grays of noticing how the Thames once flowed in a valley parallel to that in which it now flows. The false-bedded sands and the elephant beds lay in an inland trough, a good half-mile from the Thames, and the southern rim of that trough was just before you got to the present bed of the Thames. There were the two cuttings side by side—two troughs cut into the chalk. This accounts for the remains in the old trough—the deposit of elephants and so on. The Thames had a way of changing its course, and if we had not embanked it in these latter days it would very soon have shown us that it did so. But we had now imprisoned it and made it a canal. He did not know, he said, what they had done to deserve a second lecture; he would conclude by thanking them, and by saying that his reward had been the sincere interest with which every member had entered into an examination of the phenomena before them. They did not come out for a pic-nic, but to enrich their minds. The man who learned his Geology simply from books was a very poor thing, as they knew; but the man who came out to study in the field, as they had done, made acquisitions which could be gained in no

other way. They were privileged to have with them Sir Antonio Brady, the veteran elephant hunter in Essex. His work was historic—(cheers),—but happily he himself was not yet historic.

Sir Antonio Brady, after expressing the pleasure he had derived from the meeting, and from seeing and hearing his old friend, Professor Morris, discussed at considerable length the various theories which had been put forth to solve the geological problems which they met with in the deposits of the Thames Valley.

Mr. Worthington Smith, F.L.S., said he had been to West Tilbury by an earlier train than the main party, and had walked over the country to Grays, managing to find four flakes of Palæolithic age in the high gravels; he had previously found the butt-end of an implement and several flakes in the high gravels capping the chalk at Grays Thurrock. Mr. Smith referred to the numerous "Dane-holes," some open and others filled in, at Hangman's Wood.* He said these places were doubtless shafts dug in Neolithic times in quest of the layers of flint found in the chalk, and were comparable with the pits at Cissbury Camp, Worthing, examined by General Pitt-Rivers ('Archæologia,' xlii., 27). Mr. Smith had at different times found numerous flakes of Neolithic age round these pits, and indeed had lighted upon some that morning. He strongly advised that the pits should be investigated by the Essex Field Club, and reported upon. The rustics in the neighbourhood sometimes descend these places by the aid of ropes.

* These remarkable relics at Little Thurrock and elsewhere have been somewhat perfunctorily noticed by various antiquarian writers from Camden downwards. An account of them, with a ground-plan of one of the pits, is given in Palin's 'Stifford and its Neighbourhood,' p. 98, and the same author's 'More about Stifford,' p. 88. From the latter work we quote the following description, communicated by Mr. R. Lloyd Williams, of Grays:—"Hangman's Wood is a small wood, partly in the parish of Little Thurrock and partly in Orsett. At the south of this wood and on the Chadwell boundary are traces of numerous pits, which at some time or other must have existed there. Most of them are now completely filled up or fallen in, but six are still open, three of them almost in the same state as when originally made. The formation of such as are still comparatively perfect, and from which it may fairly be conjectured that the others now closed were not dissimilar, is very curious. A perpendicular shaft of about three feet in diameter, and like that of an ordinary well, descends to a depth of about seventy-five or eighty feet, the lower twenty feet or thereabouts of which pass through the chalk stratum, there reached at a depth of about sixty feet. At the foot of the shaft on each side large chambers are cut out of the chalk, rather oval in shape, with the arching slightly pointed, and the floor tolerably flat; though in one instance there appears to have been left intentionally a rude kind of bench of chalk. The measurements of these chambers vary, but their height, as a rule, is about sixteen feet, length about twenty feet, and width about fourteen or fifteen feet in the widest part." Mr. Williams conjectures that there must be nearly fifty of the pits in close contiguity. In Swancombe and Darenth Woods, in Kent, there are similar pits, and the recent remarkable subsidences on Blackheath are by some considered to be due to the presence of these "Dane-holes," the shafts of which have been only partially filled in. No sufficient examination in the light of recent archaeological researches has been yet made of these workings; and we hope the Club will adopt Mr. Worthington Smith's suggestion, and institute a practical enquiry into their nature and probable origin at no distant date.—Ed.

Cordial votes of thanks were passed to Mr. Channer, the Secretary of the "Gray's Chalk Quarries Company," to Mr. Anson, the Engineer, and Mr. Philcox, the Superintendent of the Works, for facilities afforded to the meeting. Mr. Philcox brought up a number of interesting fossils from the chalk, including the palatal teeth of fishes, *Echini*, &c.

Mr. Cole tendered his best thanks to the Rev. R. H. Brennan, M.A., Vicar of Grays, for the courtesy with which he had placed his school-room at the disposal of the Council for the discussion of the day's observations, and regretted that time would not allow them to take advantage of his ready kindness.

The 7.58 train took the members up to town, and one of the most numerous-attended and successful meetings since the Club's formation appeared to have been enjoyed by all present.

The brief bibliography of the Geology of Grays, prepared by Mr. Walker for our programme, is reprinted here as an aid to students:—

MAPS.—London and its Environs (Geological Survey Map), 1873. Or Sheet 1, S.W. (included in the above).

LITERATURE.—Prof. John Morris, M.A., F.G.S., &c.—'On a Fresh-water Deposit containing Mammalian Remains, recently discovered at Grays, Essex'. *Mag. Nat. Hist.*, Vol. ix., 261 (1836), and Series 2, Vol. ii., 539.

Prof. R. Owen, F.R.S., &c.—'Notice of the Occurrence of Remains of *Megaceros Hibernicus* and *Castor Europæus* in Brick-fields of Ilford and Grays Thurrock.' *Quar. Jour. Geol. Soc.*, iv., 42.

W. B. Dawkins, M.A., F.R.S., F.G.S.—'On the Age of the Lower Brick-earths of the Thames Valley.' *Quar. Jour. Geol. Soc.*, xxiii., 91.

A. Tylor, F.G.S.—'On Quarternary Gravels.' *Quar. Jour. Geol. Soc.*, xxv., 57. Also issued separately by Geol. Assoc.

Proc. Geol. Assoc., ii., 29, 230, 245. (Contains List of *Mammalia* found at Grays.)

Prof. John Morris, M.A.—'On the Occurrence of Greywethers at Grays.' *Geol. Mag.*, iv., 63.

Prof. Prestwich, M.A.—'Report of Water-springs at Grays.' Privately printed, 8vo, London, 1860.

Do.—'On Sand-pipes at Grays Thurrock.' *Geologist*, iv., 258.

W. Whitaker, B.A., F.G.S.—*Memoirs Geol. Survey*, iv., 36, 72, 349. 'Chalk and Thanet Sands.'

Do.—'Guide to Geology of London and the Neighbourhood.' (Geological Survey Memoir.) 'River Drifts,' chap. 6. Third Edition. Price 1s.

Searles V. Wood, F.G.S.—'On the Newer Pliocene of England,' with Map Sections, &c. *Quar. Jour. Geol. Soc.*, xxxvi., pp. 457—528.

SATURDAY, MAY 28TH, 1881.—ORDINARY MEETING.

The sixteenth Ordinary Meeting was held at the head-quarters at seven o'clock, the President in the chair.

Donations of books or pamphlets (exclusive of exchanges) were announced from Miss M. Bentley (6 vols.), Dr. Chambers (4 vols. folio), Mr. J. E. Harting, Mr. Fisher Unwin, and Mr. W. White. A unanimous vote of thanks to the donors was passed.

The Librarian announced that during the recess the Library would be open for the exchange of books every Thursday evening from seven to nine o'clock.

The following were balloted for and elected members of the Club:—Miss Madeline Bentley, Samuel D. Clippingdale, John Collingridge, George Corble, G. S. Gibson, J.P., F.L.S., D. G. F. Macdonald, J.P., LL.D., C.E., &c., Major Munro, Burnett Tabrum, J. Smyth Till, Mrs. Warburg, and George Weller, M.R.C.S.

Mr. English exhibited some flowers preserved by his process, illustrative of the advance he was still making in working out the practical details.

Mr. W. Cole said he thought the members would be pleased to hear that, at the Grays Meeting, an addition to the fauna of Essex had been made. Mr. W. F. Gwinnell pointed out to him a reddish gall upon the mugwort (*Artemisia vulgaris*), which he had failed to recognise; but on submitting specimens to their Vice-President, Mr. Fitch, that gentleman had pronounced it to be a gall, new not only to Essex, but to Britain—made by one of the Gall-gnats (*Cecidomyidæ*), *Cecidomyia foliorum*, H. Loew. Mr. Cole could do little more than announce the fact, but hoped that some information respecting the insect and its gall would shortly be forthcoming. The Club was promised a complete list of the Galls of Essex, with biological notes, by Mr. Fitch, which it was hoped would give an impetus to the collection and study of these interesting and obscure productions.

Mr. Henry Walker said that, whilst on the subject of galls, he might call attention to one which he held in his hand, and which he had found plentifully when taking shelter under some trees at Buckhurst Hill during the storm that afternoon. They were the production of an *Aphis* known to entomologists as *Pemphigus bursarius*. The presence of the insect, by some irritating but little understood process, leads to the formation of large hollow swellings on the petioles of the leaves of the Lombardy Poplar. On cutting open the galls the apterous larvæ and full-grown *Aphis* can readily be obtained, and with a little care the winged forms could be bred from the infested petioles of the poplar.

The President stated that the members of the Club present at the last meeting would probably remember that, in connection with Mr. English's remarks upon "sugaring" for moths, he had suggested the experiment of

removing the antennæ of moths, and seeing whether they found their way to sugar when thus mutilated. The object of this experiment was to test the function of the antennæ as organs of smell. Since the last meeting he had met with a paper recently published by G. Hauser (*Zeit. für wiss. Zool.*, vol. xxxiv., 1880, pp. 367—403), in which such experiments had actually been conducted, and which went to support the views advocated. In all the Orthoptera, Pseudo-Neuroptera, Diptera, Hymenoptera, and in many Lepidoptera, Neuroptera, and Coleoptera, a strong nerve had been discovered arising from the cerebral ganglion and passing into the antennæ. A terminal sensory organ with which the nerve-fibres are connected, and accessory organs formed by the pits or cones filled with fluid are described. The author gives detailed descriptions and figures of these organs in the orthopteron, *Calopterus Italicus*. The function was investigated by cutting off the antennæ of insects which had previously been tested by turpentine, carbolic acid, &c. Insects thus mutilated exhibited no repugnance to these odours, nor did they rush to food.

The Secretary read an extract from a letter received from Mr. R. M. Christy respecting the occurrence of *Cyclostoma elegans* in Essex [Proceedings, II., xi]. Mr. Christy had found the shells in considerable abundance in a deposit of alluvium at Chignal St. James, near Chelmsford. Last year, and again this spring, he found several dead shells a few inches below the surface in a railway-cutting close to Saffron Walden, but has not found any living specimens yet. The occasion on which he made his nearest approach to finding it living was one day at the end of last August, when he happened upon plenty of the animals in a wood called the "Rivy Wood," just on the other side of Linton, and also in abundance beside the road right into the town. Now as Linton is built on the very boundary between Cambridgeshire and Essex, he might fairly say that he had found living *Cyclostoma elegans* only a few hundred yards outside our own county, and before the summer closed Mr. Christy was hopeful of being enabled to report the occurrence of the animal in Essex. Another shell he very much desired to find in Essex was *Helix pomatia*.

Mr. Meldola exhibited the larva of a species of *Thera* (either *T. firmata* or *T. obeliscata*) the body of which was neatly and tightly packed with cocoons of some species of ichneumon-fly. The flies had hatched out, and he hoped at a future meeting to give the name of the species.

Mr. Harting presented to the Club a copy of his paper in the 'Popular Science Review,' on the occurrence of the Roe Deer in England, and, in doing so, he hoped the members would do all in their power to investigate the characters and history of the Deer now existing in Epping Forest. He pointed out that there were great differences between the horns of the Epping specimens and the normal horns of the ordinary Fallow Deer; and it would be of interest to endeavour to explain this modification, and to ascertain whether these animals were the descendants of Deer imported into the Forest, or whether they formed the remnant of the ancient breed of Deer surviving from remote times.

Mr. D'Oyley said that there had been no importation of Deer, and quoted the opinion of the late Mr. Grimston, a gentleman well acquainted with the Forest, that these were the descendants of animals which had inhabited the woods from time immemorial. In answer to a question from Mr. Harting he stated that, for some time after birth, the fawns were black, except at the neck, where some white appeared. This fact, Mr. Harting pointed out, was quite abnormal in the Deer-tribes. Luffman, the head keeper in the Forest, had told him that he had heard his grandfather say that Deer had been brought into the Forest; but he (Mr. Harting) did not place implicit reliance upon this, because he had been similarly informed with respect to the Deer in Lord Leonfield's park. These, he had been told, had been brought by Lord Leonfield's father from Windsor; but, on writing to his lordship to enquire, he was informed that the fact was the other way—that some of Lord Leonfield's Deer had been sent to Windsor.

Mr. Meldola observed that the history and nature of the Forest Deer were subjects well within their scope, and he hoped careful enquiries and observations would be made in the matter.

A paper, "On the Formation of a Local Museum," was read by Mr. Harting [*Transactions*, ii., 86].

The President, in proposing a vote of thanks to the author, said that he agreed almost entirely with what Mr. Harting had said so well, and he had already given expression to similar ideas on a former occasion. He thought the Society could not be too decided in excluding the proverbial stuffed crocodile and foreign objects of doubtful origin, nor too strongly urge upon its members the advisability of giving a complete and accurate record with every specimen which they might present to the Museum. The best and most useful specimens would be those collected by themselves in their own districts. He thought the Society should restrict the specimens to objects found in Essex, except perhaps objects which might be called educational and which served to illustrate in various ways the flora and fauna of the county. He would draw the line at what were commonly called antiquities. The Essex Archaeological Society dealt with these, and he would suggest that, if the Essex Field Club preserved antiquities at all, they should be only such as came fairly within the class called pre-historic. He thought their Museum should be as much as possible educational. It should have two sides; the somewhat deeper scientific aspect represented by having as complete a series as possible of all local animals, plants, fossils, and minerals; but it should also have a popular educational side. For the latter there should be diagrams showing the typical structure of plants and animals, and examples of dissections and other preparations to aid the real student. Great advance had recently been made in the mode of conserving and exhibiting many objects, and when they saw the progress Mr. English had made in preserving *Fungi* and flowering plants, he thought that a collection of plants, &c., preserved by those methods would be a valuable thing in the proposed Museum.

Mr. Roberts and Mr. Fisher Unwin suggested that the Library should be confined to works of scientific, local, or topographical interest. The President fully agreed, and thought the Librarian should be authorised to decline with thanks works which were not of scientific value; but that the Club should accept all books of scientific interest, whether local or not.

Mr. Walker referred to the beautiful drawings and preparations contained in the late Mr. Andrew Murray's collections at the Bethnal Green Museum, as being typical of what they would wish to see in their own Museum.

Mr. Wall, F.G.S., said we had nothing in this country to vie with the Museums of Melbourne and Sydney as educational Museums. At Melbourne Prof. von Müller had arranged a collection which would bear comparison with any Museum in the world for educational value. He quoted his own experience during his travels as emphasising what had been urged with regard to the great value of local Museums, and the knowledge of, and taste for, various branches of Natural History which they were likely to promote.

The next business upon the agenda paper was, "Exhibition and Description of Flint Flakes."—Mr. Worthington Smith, F.L.S., F.R.H.S., &c."

Unfortunately Mr. Smith was detained in London; but he sent a collection of Flakes, and at a short notice the President undertook to fill his place by giving a general idea of the lines of argument which had led them to state positively that there had been a Stone Age. Flint "flakes" and other implements were continually being brought under their notice, and many members of the Club had come to him with questions which showed that they were entirely unaccustomed to that simple mode of interpreting facts which had led to the belief in the existence of a Stone Age in this and in other countries. That a Stone Age had existed was shown by a variety of proofs. The evidence was not obtained from any single specimens, nor was it based upon an isolated set of facts, but there was a consensus of evidence. Mr. Meldola thought that a few general remarks upon this interesting subject might be useful, as serving to prepare the way for those more special papers which they hoped to get from Mr. Worthington Smith and other members of the Club who were doing detailed work in this field.

Passing on to the consideration of the various kinds of evidence, the President first called attention to the peat-bogs of Denmark, in which the data were chronological; there was clear evidence of a succession in time. At a certain depth were found fossil Pines associated with stone implements of undoubted human workmanship. At a later age—a less depth—there were fossil Oaks, with implements of bronze; and at still later date the Beech was found in association with weapons of iron. Thus from one locality they had evidence of the use successively of stone, bronze, and iron. But of course that did not mean that at any given

period the whole of the human inhabitants of Europe were using stone exclusively, at another period nothing but bronze, and at another period only iron. As pointed out by Sir John Lubbock, these ages no doubt overlapped, and stone might have been in use in one country at a period when bronze had found its way into a neighbouring country. The remains found in the peat-bogs simply indicated three successive stages of civilisation in one district, but there was no reason whatever for believing that each stage was absolutely contemporaneous with a corresponding stage throughout the whole of Europe. Then there was evidence of another kind furnished by the well-known refuse-heaps or "kitchen-middens" found on the shores of the Baltic, consisting of great mounds of shells which appear to have been cast away as refuse by the people of the Stone Age. In these heaps were found none but stone implements; they belonged without doubt to the Stone Age, and no metallic weapon of any kind had ever been found in them. Facts of this sort of course went to show that the use of stone preceded that of metal, which required greater skill and knowledge in order to work it, and they further went to support the view that our ancestors were of a more barbarous type than their successors, and not, as is often stated, that man has been degraded from a more civilised state.

The Stone Age had been divided into two periods, the Neolithic or Newer Stone Age, and the Palæolithic or Old Stone Age. The first evidence of man's advent upon the earth, as afforded by these worked flints, according to the generally-received opinion, showed that he appeared about the time of the last glacial epoch which came on at the close of the great Tertiary Period of geologists. Of late years some authorities had stated that worked flints had been found in strata of inter-glacial or possibly of even pre-glacial age. The evidence had been much disputed, but he (the President) was glad to see that Prof. Ramsay, the Director-General of the Geological Survey, in the last edition of his 'Physical Geology and Geography of Great Britain,' had unhesitatingly accepted Mr. S. B. Skertchley's statement that he had found flint implements in brick-earth beneath the Chalky Boulder-Clay near Brandon, in Suffolk. So far as he himself was concerned, the President saw no *a priori* reason for refusing to accept the evidence of man's enormous antiquity—an antiquity which might extend back to pre-glacial times and even as far back as the Miocene Period. The implements of the Old Stone Age were of a much ruder type than those of the Neolithic Period, but that they were both of human workmanship would not for a moment be doubted by anyone who would examine them fairly and intelligently. Palæolithic implements were found in association with animals now extinct, and their enormous antiquity was further proved by the great elevations at which the flints were sometimes found above the existing rivers. By means of diagrams drawn on the black-board, Mr. Meldola then showed the manner in which valleys were hollowed-out by river-action, deposits of alluvium and gravel being left at different elevations

as the denuding action of the river went on, so that the lower beds of alluvium were of course formed much later than the higher beds. The association of flint implements with the remains of extinct Mammalia in the high-level gravels brought them face to face with the most ancient evidence of the existence of man. Whether that period represented the actual appearance of man upon the globe was of course another question. He thought that most probably it did not, because the mere intelligence required to work a flint must have taken ages to develop. M. Boucher de Perthes, in 1847, was among the first to call attention to the occurrence of flint implements associated with remains of the Mammoth in the high-level beds of Abbeville, on the River Somme; and his observation, like many other new observations in Science, was allowed to remain for long unheeded; but the matter had at length been inquired into, and it had gradually become established that the human makers of these Palæolithic weapons were contemporaries of the Mammoth and other extinct animals.

There was yet another class of evidences. In many limestone countries water charged with carbonic acid had eaten away large caves in the limestone. These caves, many of which were probably pre-glacial, had served as storehouses for the *débris* left in remote ages, and these remains had there become cemented up and were waiting to be read as records of the past. In some of these caves the whole chronological data had been preserved; and we had the whole series, from post-Roman to pre-Roman, down to the ages of iron and bronze, and lastly to the Neolithic and Palæolithic Periods. The occurrence in these caves of the same animals that were found in the high-level gravels showed that the caves were also of Palæolithic age. In the South of France, in a cave belonging to a period intermediate between the two Stone Ages, there had been found a fragment of a Mammoth's tusk, with a figure of this animal carved upon it by the hand of Palæolithic man, and also the drawing of a Reindeer on a portion of the antler of this animal, together with other pre-historic works of rude art. A more convincing proof of the co-existence of Man with the Mammoth could not possibly be given. Palæolithic implements were somewhat rare, and were generally found at considerable depths in ancient river gravels; Neolithic implements were much more commonly distributed, and were found either actually on the surface of the ground or at a slight depth beneath it. Their esteemed honorary member, General Pitt-Rivers, had opened some of the ancient hill-forts at Cissbury, near Worthing, Sussex, and there he appeared to have found a flint-implement manufactory, as there were hundreds of implements in all stages of manufacture, and flakes scattered about in profusion. A similar manufactory had been recently discovered near Crayford, in Kent. The conclusion seems to be that these implements had been objects of barter, and that factories had been established at certain places where the chalk had been tunnelled into for the purpose of getting out the flints. Mr. Meldola then explained how worked flakes could be distinguished from merely accidental scalings or fractures, all of them having what is known

as a "bulb of percussion," and illustrated his remarks by specimens taken from those sent by Mr. Worthington Smith which had been found in the area of the British Camp near Ightham, Sevenoaks, Kent.

Mr. Roberts, F.G.S., cautioned the members of the Society against supposing that there was any very distinct line between the Palaeolithic and the Neolithic Ages. The Palaeolithic implements, which were roughly formed, were so far mixed with the Neolithic, for a reason which he would give later on, that when they found Palaeolithic implements they must not conclude—from that, at all events—that their age was very great. Implements which were not polished, which were little more than flakes, would naturally be made by hunters or by people who wanted implements in a hurry. And often they might expect that, in the summer season, when a hunter came across the then mainland—now the German Ocean—into Great Britain, he would leave a small deposit of implements, which, when found, might be considered Palaeolithic. And they must not consider that Neolithic implements were all done with after bronze was introduced. Bronze would have been an article of luxury and used by the chiefs, whereas the rank and file would not have been able to use bronze weapons, but must have been content with stone ones. In all probability stone implements were used even long after the introduction of iron. Then again we had almost contemporaneous evidence of the manufacture of stone implements—at all events they were manufactured in America as late as the middle of the 16th century. Flint implements were then made by the Indians at Montreal, whereas a couple of hundred years afterwards they were utterly unknown, and when dug up—had it not been known by certain memoranda made by a voyager that there had been that camp of Indians there—they might have been put down to a period hundreds or even thousands of years previously. Another point to be taken into consideration was this: it must not be taken that the engravings on the bones were always engravings of contemporaneous animals. There was considerable probability that they were of the nature of totems which descended from father to son, as they did among the American Indians; and there was a probability that, instead of these figures being pictorial representations of animals living at the time—although they would have been that in the first place—they were simply the designs of chiefs, and might thus have kept to the Mammoth, though the Mammoth had then no existence. He would add to the manufactories the President had named one which he had not mentioned: the holes known as Grimes's Graves, which were in all probability made to get into good strata of flints—flints which would work easily. As supporting the theory that flint implements were objects of barter, Mr. Roberts mentioned that they were found in considerable numbers in places destitute of the stone from which they were made; and certain stones had been carried all over Europe, and might be traced almost to one particular spot where the factory was. As to the question of difficulty in distinguishing the worked flints, he said that they might get doubtful flakes and be uncertain

about them ; but directly they got a manufactured one the signs would be so clear that there could be no difficulty in saying whether it was natural or artificial. Mr. Robarts concluded by stating that he had found what he believed to be a very good flake in the brickfield at Honey Lane, and he thought that if the members of the Society would work that field they might obtain good results.

Mr. Henry Walker said, if he understood the drift of Mr. Robarts's remarks at the commencement, it was really to minimise the antiquity of man.

Mr. Robarts—Not at all.

Mr. Walker said he thought he detected in the speaker's reference to the Hochelaga implements of the 16th century a following of the line which Professor Dawson had taken since he had become a "reconciler." But a Stone Age was to be found in our own days without going back two hundred years. He held that there was an enormous gap between the Palaeolithic and Neolithic Ages in Western Europe, as evidenced by the excavation of valleys and other great physical changes, and especially by the great change in the fauna. With regard to the social condition of Palaeolithic man, he thought it was a great mistake to look upon him as a savage. Those who had read Darwin's 'Voyage of the Beagle' would recollect the author's description of certain native tribes in South America who might properly be so designated. They wore no clothing, had no habitations, they fed on worms, and lay down on the bare ground in all weathers. Now Palaeolithic man was more than this. He was at least a manufacturer ; he made implements, and for all we know to the contrary might have had a social and tribal polity. He had left no structures behind him, and his habitations were probably wattles. The country had been submerged since the time of Palaeolithic man, as was shown by the beds of alluvial gravel which overlies the beds containing the old Mammalia. It was remarkable how the once-despised gravel had come to the front lately in geological enquiries. Everywhere now the talk was about the gravels, their age, and conditions of deposit. The reason why the gravels were found in the valleys was obvious. In times of flood and submergence everything on the surface was liable to be washed down to the lower levels, and hence the valleys had become the repositories and museums of the drift of the landscape. They must make up their minds to hear more and more of the gravels and their contents, for they would long continue to be the geological topic of the day. With regard to the so-called "Dane's holes," it was agreed by the best observers that they were artificially made, and had served as places of refuge, perhaps when the old Norse pirates were ravaging the shores of the Thames.

Mr. Robarts explained that he did not wish to throw any doubt upon the great age of man. On the contrary, he believed man was here at the Glacial epoch. His remarks went only to the manner in which the different periods overlapped each other.

Mr. Meldola—If he were here at the Glacial epoch he must have been here at least two hundred and forty thousand years ago. (Laughter.)

Votes of thanks were passed to Mr. Worthington Smith for his gift of the series of "flakes" to the Museum, and to Mr. Meldola for his interesting impromptu lecture. The meeting then resolved itself into the usual *Conversazione*, at which the Rev. F. A. Walker sent for exhibition some specimens of "banded flints" from the chalk formation at Christchurch, Hants; and Mr. R. M. Christy sent some flint implements, including eight from Canada, one from the Bartlow Hills, three more or less perfect implements from Cissbury, one from South Downs, and a number of curious flint chips from Cissbury Hill, where similar ones may be obtained by the bushel; also a few gun-flints, to show that the manufacture of flint had lasted to these days.

MONDAY, MAY 30TH, 1881, AND FOLLOWING DAYS.

REPORT ON THE CLUB'S EXPLORATION OF AMBRESBURY BANKS,
EPPING FOREST.

At the Field Meeting held on July 3rd, 1880, the President suggested that the scientific exploration of the two ancient earth-works, known as Ambresbury Banks and the Loughton Camp, would be a fitting and worthy task for the Club to undertake. The suggestion was warmly received by the members present, and General Pitt-Rivers very readily promised his valuable aid and advice in the matter. As detailed in the Report of the Ordinary Meeting on October 30th, 1880, permission to make the necessary excavations was granted to the Club by the Epping Forest Committee of the Corporation of London, and under date October 12th a circular to the members was issued by the Honorary Secretary, making a strong appeal for funds to carry on the works, the cost of which would be too great to be defrayed out of the ordinary income of the Society. In response to that appeal the following sums were subscribed by the members of the Club named:—

FOREST CAMPS EXPLORATION FUND.

Subscriptions, 1880 and 1881.

	£	s.	d.		£	s.	d.
Brady, Sir Antonio . . .	1	1	0	Fawcett, W.	0	10	6
Burney, George . . .	1	1	0	Fitch, E. A.	1	1	0
Buxton, E. N.	1	0	0	Gardner, Prof.	0	10	6
Buxton, Sir Fowell . .	1	0	0	Godwin, George J. . .	0	10	6
Buxton, T. F. V. . . .	1	0	0	Goss, Herbert	1	1	0
Carrington, J. T. . . .	1	1	0	Gould, F. C.	0	10	0
Christy, R. M.	0	10	6	Grut, Ferdinand . . .	1	1	0
Cole, William	1	1	0	Harcourt, G. C. . . .	0	5	0
Copland, Mrs.	0	5	0	Heathfield, E.	0	10	0
Copland, P.	1	1	0	Hore, J. P.	1	1	0
Copland, P. F.	0	5	0	Howard, W. D.	1	1	0
Crouch, Walter	0	10	6	Jervoise, Sir J. C. . .	1	1	0
Darwin, Charles	1	1	0	Johnston, Andrew . .	1	1	0
Dunning, J. W.	1	1	0	Jones, D. B.	0	5	0

	£	s.	d.		£	s.	d.
Kelly, Alexander . . .	1	1	0	Spicer, Albert. . . .	1	1	0
Letchford, R. . . .	1	1	0	Thomas, Charles. . .	1	1	0
Lockyer, Alfred . . .	0	10	6	Tozer, A. H.	0	10	6
Lockyer, G. H. . . .	0	5	0	Trimmer, Dr.	1	1	0
Meldola, R.	1	8	0	Unwin, Fisher	0	10	0
Melles, William . . .	2	0	0	Walker, Henry	1	1	0
Owen, John	0	10	6	Wheeler, E.	1	1	0
Pitt-Rivers, General. .	5	0	0	Wilson, Rev. W. L. . .	1	1	0
Ramsden, Hildebrand .	1	1	0	Winstone, B.	1	1	0
Robarts, N. F.	0	10	0	Yeates, Mrs.	0	5	0
Saul, George T. . . .	1	1	0				
Smith, W. G. S. . . .	0	10	6	Total	£46	8	0
Snell, E. A.	0	10	6				

Sufficient funds having been subscribed for the investigation of one Camp, at the Council and Ordinary Meetings held on February 26th the following members were nominated as a Committee to conduct and supervise the operations:—The Officers *ex officio*, Mr. D'Oyley (Honorary Surveyor), Messrs. H. A. Cole, J. English, N. F. Robarts, Charles Thomas, T. Fisher Unwin, and F. H. Varley; and subsequently Mr. A. Tozer and Rev. W. Linton Wilson joined the Committee. It was decided to begin with Ambresbury Banks; the contract for the work was taken by Mr. Charles Cuthbert, of Loughton; and very carefully made plans and working sections were provided by the kind exertions of our Honorary Surveyor.

On the morning of May 30th the contractor and workmen were duly on the ground, together with our directors General Pitt-Rivers and Mr. D'Oyley, and several members of the Committee. A part of the rampart to the left-hand side entering the Camp from the Epping Road had been staked out, but it was found that excavations there would necessitate the removal of at least one large tree; and a site to the right of the entrance free from trees of any size was finally chosen. The ground was speedily staked-out by the Surveyor, the bushes cleared away, and the turf peeled off. Then commenced the careful work which demanded the close attention of the explorers for eight or nine days. The earth was systematically dug out in "spits" by the workmen and thrown into the barrows or cart, where each spadeful underwent a rigorous examination by the several members of the Committee on "search duty." It was found impossible to use the sieve in consequence of the clayey and agglutinative nature of much of the soil, and small geological hammers and extemporised spades were soon busily employed in turning over and over the *débris* of the ancient rampart. But some of the searchers found that their hands were really the best instruments in such close work, and several of the "finds" were the result of persevering digital exercises. Throughout, the workmen were very careful and watchful, faithfully carrying out the directions given to them. The plan of operations and theory of the work are set forth in the Report (Transactions, ii., 55), and need not be recapitulated. As evidence of the care taken, and as a slight

acknowledgment of their freely-rendered services, the names of those acting as watchers and directors of the work, with the dates of their attendances, are here given :—

Monday, May 30th.—General Pitt-Rivers, Messrs. D'Oyley, Meldola, H. A. Cole, and W. Cole.

Tuesday, May 31st.—Messrs. Meldola, D'Oyley, A. Lockyer, H. A. Cole, and W. Cole.

Wednesday, June 1st.—Messrs. Meldola, D'Oyley, F. H. Varley, H. A. Cole, and W. Cole.

Thursday, June 2nd.—Messrs. Meldola, H. J. Barnes, H. A. Cole, and W. Cole.

Friday, June 3rd.—Rev. W. Linton Wilson, Messrs. D'Oyley, Meldola, H. A. Cole, and W. Cole.

Saturday, June 4th.—Messrs. Roberts, Fisher Unwin, Meldola, D'Oyley, and W. Cole.

Monday, June 6th.—General Pitt-Rivers, Messrs. Fisher Unwin, Meldola, D'Oyley, H. A. Cole, and W. Cole.

Tuesday, June 7th.—Messrs. H. A. Cole and W. Cole.

Wednesday, June 8th.—Messrs. D'Oyley, W. S. Hodge, H. A. Cole, and W. Cole.

The excavations were watched at night by two of the Forest Keepers, Mr. Luffman and Mr. Butt (permission being kindly given by our member, Captain M'Kenzie, Superintendent of the Forest), in order to protect us from unwelcome visitors; but their office was almost a sinecure, as no interference with the work was attempted.

As the investigation progressed it became more interesting. We quickly came upon vestiges of man, and evidence of the use of fire in the shape of bits of charcoal and burnt clay. Early on Wednesday morning a considerable deposit of this kind was unearthed near the spot marked "Charcoal" on the section (Plate IV.)—quite a quantity of charcoal, burnt clay, and calcined stones, evidently the remains of a long-continued fire. Near this spot a piece of rim of a pot and a flint flake were turned up. We were soon able to distinguish the "old surface-line" or original undisturbed soil of the Forest, the exact limits of which it was so necessary to define. The artificial character of the soil composing the rampart was often very noticeable, the successive layers of deposited earth being readily distinguished; Mr. D'Oyley has indicated this non-natural stratification by shadings on his section. Great care was exercised in making out the true section of the ditch or fosse, the determination of its exact construction being considered by General Pitt-Rivers a matter of much importance.

In the report of the investigation in the 'Transactions' but a passing reference has been made to the scanty literature of this earthwork. The Editor has been enabled to find but very few references to it. It was the custom to ascribe it to the Romans, but local tradition perhaps more justly connected it with the Amazonian heroine, Queen Bodug, and the

scenes of the latest struggles of the British against invasion and outrage. The best account of it, previous to Mr. Cowper's papers referred to below, was given by Gough in his edition of Camden's 'Britannia' (1789), vol. ii., 49, he deriving his information mainly from a local antiquary, Mr. Lethieullier (of Wanstead?). Speaking of Copt Hall, he says:—"Just without the park, on the south-east side of the London Road, is an oval Camp called Ambresbury Banks, and probably British.—See plan of it, Plate I., fig. 4." He then quotes an interesting MS. letter from Lethieullier, as follows:—"This intrenchment is now entirely overgrown with old oaks and hornbeams. It was formerly in the very heart of the Forest, and no road near it, till the present turnpike road from London to Epping was made almost within the memory of man, which now runs within a hundred yards of it; but the intrenchment cannot be perceived from thence by reason of the wood that covers it. It is of an irregular figure, rather longest from east to west, and on a gentle declivity to the south-east. It contains near twelve acres, and is surrounded by a ditch and a high bank much worn down by time, though where there are angles they are very bold and high. There are no regular openings, like gateways or entrances, only two places where the bank has been cut through, and the ditch filled up very lately in order to make a straight road from Debden Green to Epping Market. The boundary between the parishes of Waltham and Epping runs exactly through the middle of this intrenchment, whether carried so casually by the first settlers-out of those boundaries, or on purpose, as it was then a remarkable spot of ground, I leave to better judgments to conjecture. As I can find no reason to attribute this intrenchment either to the Romans, Saxons, or Danes, I cannot help concluding it to have been a British Oppidum, and perhaps it has some relation to other remains of that people which are discoverable in our Forest."

The above account of Mr. Lethieullier's is probably the basis of all that has been said about the Camp by local historians. A rough plan of the Camp is given in Mrs. Ogborne's 'History of Essex' (1814), apparently a copy from the one in the 'Britannia'; and Morant, although his history was published in 1768, appears to have derived his information also from Lethieullier. Mr. Cowper's papers were called forth by his lighting upon the "Loughton Camp" in the year 1872. His first paper entitled 'Notes on an Entrenched Camp in Epping Forest' was read at the Meeting of the Royal Archaeological Institute, November 5th, 1875 (Arch. Journal, vol. xxxiii.); a second paper was read at the Colchester Meeting of the Institute in 1876, and is published in the same volume. Subsequently another paper was published for Mr. Cowper by the Committee of the Epping Forest Fund (1876), with lithographed plans by Mr. D'Oyley; and in 'Cassell's Family Magazine,' vol. iii. (1877), page 153, the same writer gives a very interesting *résumé* of his observations. These papers are well worthy of attention, and contain almost all the reliable information about the Forest Camps extant previous to the Club's explorations.

In the attempt to connect the Ambresbury earthwork with the last exploits of Queen Boadicea, our authors have been much puzzled by the well-known story in 'Tacitus,' which locates the battle between Soutonius and the British in an open plain, closed in the rear by a forest—a station wisely chosen by the Roman General to guard against ambuscades. In a note by Gough on the passage in the Roman historian, he says (Gough's 'Camden,' vol. i., xxxviii., note):—"Mr. Morant, upon comparing all accounts and circumstances, persuades himself that this battle was fought near Epping, by the side of Copthall Park, where is now a fine bank called Ambresbank, enclosing about eleven acres ('Hist. of Essex,' i., 46—'Colchester,' p. 23, note 2). But this obvious circumstance of the action being in a plain, and all this part of the country at this time most probably forest, seems to make directly against him. At the same time it must be owned that the name of the Camp gives it to the Britons. It might have been an *oppidum*; but Tacitus's account gives no reason to think they threw up any work at this juncture. The want of barrows is an argument that so great a slaughter could hardly have happened here." Recalling this opinion of the last century antiquary, it is a curious fact that our excavations afforded not the slightest evidence of the site, at the period of the construction of the Camp, having been woodland. The old "surface-line," which was so carefully watched and studied, was composed of a light-coloured and very sandy clay, such as may be met with on the surface of the open heathy ground in the forest. We met with no indications of decayed stumps of trees or vegetable humus. Our workmen at once noticed the similarity of the soil at the base-line and the surface-soil of the open forest. The woodland at and around the Camp is evidently very modern, and, without giving too-ready credence to the theories of Morant and others which connect the spot with "the last stern battle-plain" of the despairing Queen, it may be allowable to suggest that the side and surroundings of the Camp in the Roman era were probably an open expanse of moor or heathland. Moreover, it seems unlikely that a Camp would have been thrown up in a dense forest, which, by affording cover to an approaching foe, would vitiate in great measure the main end in view—the security and isolation of the defenders.

Bearing in mind the results of our explorations, it is hardly necessary to throw another stone at the exploded hypothesis that Ambresbury was a Roman station; but it should be noted that the high road which at present runs by the Camp to Epping is comparatively a very modern one. It was possibly originally a mere forest track leading to the little hamlet of Epping Street, the main "ancient way from Harlow to London being from the corner of Wintry Wood, where the turnpike stands, across the forest to Abridge." The road as it at present exists is certainly not older than the beginning of the 16th century, for in 1516 Master John Baker, a worthy mercer of Epping, bequeathed a charge upon certain of his estates for the repairing of the way. "This," says Morant, "seems to have been for the sake of Epping Street, to induce travellers to go that way, and

the intention was answered." The road was therefore not founded on a Roman one, and the Camp in early days was hidden away in the depths of the Forest (using the word "Forest" in its legal sense, of a wild unclaimed tract of country). We are told that it was an instinct with the Romans in the erection of their forts to attend closely to means of rapid access and intercommunication. Where Roman Camps or settlements have been, there are the remains of the Roman roads, straight, useful, and ugly. But the British loved to hide their Camps and Kraals in the midst of the wild moorland, morass, or woodland of primeval England, and cared for no better roads than mere forest-paths, curving and straying as the oaks permitted, or as open glade or heath tempted—bad roads, perhaps, but to this day charming and beautiful!

Although the occupation of watching the gradual and systematic removal of the rampart was oftentimes felt to be somewhat monotonous and tedious, yet the weather during the greater part of the time was so balmy, and the fresh spring woods so cheerful and pleasant, that the members on duty felt themselves amply repaid for their enforced sojournings in the "house of the forest," with its pillared arches, shadowy aisles, and arabesques of leaves and flowers. In the early mornings, especially, as we rode down from Loughton at five o'clock to meet the workmen at the Camp, the quiet beauties of the "merry green woods" sank deeply into our minds; the sweet blossoming hawthorns bordering the Epping Road, snowy white when newly petaled, but flushing with a lovely pink as the myriads of tiny roses hastened to decay, were surely never seen in greater glory. Friends from time to time strolled over to watch our proceedings, and to share our primitive meals at the "Wake Arms"; and our entomologists took advantage of the sunshine to organise hunts in the woods about the Camp, meeting with a fair amount of success. Once a swarm of bees settled on a bush not far from the scene of operations, and as it was "a swarm in May" and therefore worth "a load of hay," a neighbouring cottager quickly hived the little emigrants with all the accustomed ritual. A few fossils were obtained by breaking the flints so abundantly turned up with the soil, and some of the nodules when broken were remarkable for their banded and agate-like colours. Good herds of the forest deer were espied more than once as we wended our way home through the woodland rides in the gloaming of the June evenings, and on the whole we agreed that, with fine weather, camp exploration in an ancient forest was an employment by no means unenjoyable.

Our learned conductor deeming it necessary that the levels of the ground in and around the Camp should be noted on the plan, two days (July 26th and 28th) were given to this further work by Mr. D'Oyley, assisted by Messrs. H. A. and W. Cole and our coachman. Captain McKenzie very courteously allowed us the use of his surveying instruments, Mr. D'Oyley's being then in service in another part of the country. As intimated in the 'Transactions,' the results of this additional survey are recorded on Plate III.

SATURDAY, JULY 25TH, 1881.—FIELD MEETING AND ORDINARY MEETING.

This afternoon, by the kind invitation of the Rev. W. Linton Wilson, M.A. (Vice-President), the Club held a Field Meeting at Chigwell. During the morning the rain poured heavily; but the weather cleared somewhat in the afternoon, and only an occasional shower interfered with the comfort of the visitors. Some forty odd members and friends assembled at the Chigwell Lane Station on the arrival of the 2.13 train, some coming in carriages by road from Buckhurst Hill and Woodford. Among the company was Mr. Fletcher, President of the Ottawa (Canada) Field Club, who was warmly welcomed. The main objects of the meeting were the collection of microscopical and botanical specimens; and members were requested to bring collecting apparatus with them, and to forward their microscopes to "Oakhurst," Mr. Wilson's residence, which was to be the goal of the afternoon's ramble. But unfortunately the rain had been so heavy, that it was impossible to make incursions in the fields and coppices with any reasonable degree of facility or pleasure, and very little could be done in the way of collecting. Our members, Mr. Oxley, F.R.M.S., and Mr. Letchford, F.R.M.S., and several others managed to conduct some researches after *Infusoria* successfully in the back-waters of the Roding and in some ponds near Chigwell, and they afterwards exhibited their spoils at the evening meeting. The bulk of the party were perforce obliged to content themselves with a pleasant social stroll through the lanes to the old church, discussing as they went the *flora* of the banks and hedges, and recalling memories of rambles when bright skies and drier surfaces had tempted our collectors into fresh fields and pastures new. But in spite of these drawbacks the walk was a pleasant one, and at the old church of St. Mary's the party was reinforced by Mr. Saville Kent and Mr. T. Fisher Unwin, who acted as our conductors. The church had been thrown open for inspection by the kindness of the Vicar, the Rev. W. S. Meadows. Mr. Unwin read a most interesting paper on the ancient and modern history of Chigwell and neighbouring hamlets, commencing by referring to our great novelist's connection with the village:—"Chigwell, my dear fellow, is the greatest place in the world. Name your day for going. Such a delicious old inn opposite the church-yard—such a lovely ride—such beautiful forest scenery—such an out-of-the-way, rural place—such a sexton! I say again name your day." Thus wrote Charles Dickens forty years ago last 25th of March to his friend and biographer, John Forster; and Forster adds that—"The day was named at once; and the whitest of stones marks it now in sorrowful memory. His promise was exceeded by our enjoyment, and his delight in the double recognition of himself and of Barnaby, by the landlord of the nice old inn, far exceeded any pride he would have taken in what the world thinks the highest sort of honour." Most of those gathered there that day would re-echo Dickens's verdict on the charms of Chigwell, and Chigwell people might well be proud of their association with the author

of 'Barnaby Rudge.' Forty years had gone by, and yet the village could have little changed since Dickens first saw it. It remained an illustration, and a most pleasing one, of an old country hamlet, the like of which Washington Irving and Miss Mitford described so charmingly in their books, and Mr. Caldecott drew with such graphic beauty; yet not ten miles from London! Search the city round in double the radius they would not find its equal. The village gives its name to a parish in the Hundred of Ongar, and in years gone by was contained in the great forest of Essex, when the forests now known as Epping and Hainault met on the banks of the Roding and formed one great woodland. The speaker examined the derivation of the name (which is spelled in many ways in old records), tracing it to the two Saxon words "cing" and "well" or "Kings-well." Of the seven manors comprised in the parish, two, Chigwell and Woolston, according to Domesday Book, were royal demesnes, Earl Harold holding them of Edward the Confessor; hence the first syllable. To find the origin of the second they must go to the hamlet of Chigwell Row; and in an old MS. about the year 1746 he read—"If any credit is to be given to ancient report, we may reasonably conclude that the salutary effect of this water was well known ages ago, the place where it issued out being signified with the name of King's Well—for Chigwell is only a corruption of King's Well, C and Ch in the Saxon language having the power of K, but by losing that power and dropping the N the name was ridiculously (*sic*) converted into Chig." . . . "This much injured tho' useful water is found issuing out of the declivity out of the rising hill on the south side of the wind-mill, in the Wood or Forest." . . . "This is supposed to be the old well, and in all probability was so, as the vestiges of some kind of building appear at this day. Another opening is discovered to ye west of this hill, and a third well has been lately dug on the north side of the same hill, in a field behind the house called Whitehall, which proves to be more strongly impregnated with mineral qualities than either of the other two." Also Dr. Frewin, born at Chigwell Row, and celebrated in his day, says—"This county, especially the hilly parts of it, has been remarkable for the variety of medicinal waters, which have been taken notice of from time to time by several able physicians and historians; and upon a strict examination I find that the water which vents itself at several openings at Chigwell is as much deserving of notice as any in the county, and I doubt not will be found as efficacious in many chronical diseases as any in the kingdom." Here, then, they had evidence of the existence of these wells early in the last century. But the name of the village carried them back to Saxon times, and it is not impossible that our Roman conquerors may have visited it. The Romans understood the value of mineral springs and the bath, and at several of our English springs their presence has been established. In Essex they had plenty of evidence of their occupation. In their own neighbourhood, at Leyton, and in the town of Ongar, and even within the borders of Chigwell parish, remains had been found

supposed by some to be of Roman origin. In these details Mr. Unwin thought they had sufficient evidence of the origin of the name of "our village."

The Church dedicated to St. Mary is of great age. But the first notice of it the speaker could find was in the reign of Edward III., when from 1329 to 1400 the presentation was in the gift of the families of Goldingham, Lords Bouchier and Dorwood.

In 1474, during the reign of Edward IV., the rectory was united to the prebend of St. Pancras in St. Paul's. But prior to these dates, some chapel, chantry, or monk's cell most likely existed. Morant, in his 'History of Essex,' dated 1768, says—"St. Mary's consists of a body and a north aisle. Both church and chancel are leaded, and the aisle tyled. The east end of this aisle is called the little chancel, being the burial place of the ancient family of Scott. The belfry is of timber, with a spire shingled, and in it are five bells."

Looking at St. Mary's to-day, we are struck more by its picturesque position, the rural charms surrounding it, and the unique avenues of yew which lead up to its doors; these groves of yew reminding us of the days long gone by, when custom planted them in the churchyards of our villages so as to give a good supply of wood to the yeomen to make their bows to serve them in warfare or chase. In the records searched Mr. Unwin had found no mention of these avenues, but in a picture he had seen, dated 1769, they were represented as full-grown trees, forming an avenue. The general appearance of the building reminded them of many of their Essex churches, such as Lambourne and Ongar. The most interesting architectural feature is the fine south door, with the zigzag or chevron mouldings of the Norman period. The church is rich in monuments and hatchments, to the memory of many of the old residents, Lords of Manors and Donors of Bequests. One of the quaintest is to the memory of Thomas Coleshill, who died 1595, and it tells us he was servant to Edward VI. and Queens Mary and Elizabeth; it depicts him kneeling at a stand with books, the lady with her two daughters behind her in the same attitude, dressed with large ruffs and lappeted head-dresses, with two Latin inscriptions. The magnificent brass to the memory of Bishop Harsnett, now in the aisle, is most interesting. Till about fifty years ago it was fixed against the north side of the chancel; originally, no doubt, it would have been placed on the floor. We read that he was buried at Chigwell, by his own desire, at the foot of Thomazine his wife. The inscription in Latin is as follows:—"Here lieth Samuel Harsnett, formerly vicar of this church. First the unworthy Bishop of Chichester, then the more unworthy Bishop of Norwich, at last the very unworthy Archbishop of York, who died on the 25th day of May, in the year of our Lord, 1631. Which very epitaph that most reverend prelate, out of his excessive humility, ordered by his will to be inscribed to his memory." The monument represents him in a mitre, rich cope, rochet and chimere, holding a pastoral staff; and Mr. Unwin believed it to

be the latest representation of the canonical vestments on an English brass.

The lecturer then entered into some interesting details of the history of the manors and mansions contained in the parish, which would be out of our scope to reproduce; * and went on to say that Chigwell, although it could not claim to be the birth-place of any men of world-wide fame, might yet be proud of several who lived and worked in the village, and who must in their days have influenced its life and character. Of these Samuel Harsnett, Archbishop of York, must be of most local interest—born in 1561, in St. Botolph's Street, Colchester, and the son of a baker, he was, therefore, an Essex man. Getting some learning, how the speaker knew not, he was sent to Cambridge; and in 1597 he became Vicar of Chigwell, and successively of other parishes in the county; also Arch-deacon of Essex, Bishop of Chichester, and later of Norwich. On the 13th of April, 1629, he founded the two Free Schools, one called the Grammar, the other the English school. His regulations for the schools are particular and quaint; for instance, the lads are "to read the ancient Greek and Latin poets, but no novelties nor conceited modern writers"; and again, "it is expressly provided that the master be no puffer of tobacco." The schools were founded for the use of Chigwell and neighbouring parishes, and have no doubt sent many good men and true into the world. But their most famous scholar was William Penn, founder of Pennsylvania: Penn was born October 14th, 1644, on Tower Hill, and his childhood from about 1650 to 1655 was spent at Wanstead. He must have entered the school when nearly ten years of age; how long he remained in it the speaker could find no trace. Surely Chigwell and Essex might claim to have had their influence in forming the character and directing the future life of the great Quaker Colonist. That year, almost that month, 200 years ago, the New England Colony was founded. Their American cousins were about to celebrate its bi-centenary, and it was well for them at Chigwell to recall it to their remembrance.

Chigwell's best known Rector, Mr. Unwin thought, was the Rev. William Paley. In 1794 the Bishop of London presented him with the Prebend of St. Pancras, which included the Rectory of Chigwell. The same year he published his well-known work, 'A View of the Evidences of Christianity'; that, with his other famous books, 'Horæ Paulinæ' and 'Natural Theology' were still read and used as text-books in schools. Before Paley, in point of date, we find John Rogers had the Rectory conferred on him in August, 1551. Previously, whilst Chaplain at Antwerp, he assisted Tyndale and Coverdale in making the first translation of the Bible into English. Whilst Rector of Chigwell, during Queen Mary's reign, he was burnt at Smithfield, at the instigation of Bishop Bonner, on February

* The full text of Mr. Unwin's paper was given in the 'Essex Times' for Friday, July 1st, 1881, to which we beg to refer our readers; and the Editor is glad to acknowledge his indebtedness to the excellent reports of our meetings contained in that newspaper.—Ed.

the 4th, 1555, for his attachment to the Reformed Religion. At the stake pardon was offered him if he would recant; but he heroically refused, and history told them, "The fire was put under him, and when it had taken hold of both his legs and shoulders, he as feeling no smart washt his hands in the flame, as tho' it had been in cold water, and after lifting up his hands to Heaven, not removing the same until such time as the devouring fire had consumed them, most mildly this happy martyr yielded up his spirit into the hands of his heavenly Father." As another illustration of church history in Chigwell, they might remember Dr. Emmanuel Utie as Rector. The living was sequestered by order of Parliament, on the 12th of July, 1643, the charge against him being for that he hath affirmed "that there hath beene no true religion in England these forty years, and that he loved the Pope with all his heart," and "that if the devil himself would have holy orders put upon him, he would be inspired of the Holy Ghost, &c." Mr. Unwin regretted that he could find but little record of the ladies in Chigwell; one, however, he could not forget, *viz.*, Mrs. Joan Simpson (a lady who took in washing, he was told); in 1857 she left funds in Chigwell, the proceeds of which were to be applied to keeping up the footpath from Abridge to Winn Bridge, Snakes Lane; to this lady, those who have to tramp that road must be ever grateful.

Mr. Unwin said he had told the story of Chigwell, as far as he had time to make research and jot down what he could learn. He thought that for a rural village it might stand by any other in the county, at least for interesting associations. In a few sentences at the close of his paper Mr. Unwin referred to some resemblances between the names of the characters in 'Barnaby Rudge' and existing names in Chigwell; and pointed out that the King's Head at Chigwell was really Dickens's "Maypole," the name being transferred by him from the Inn at Chigwell Row. Opposite the latter Inn there used to stand a post, as to the nature of which Mr. Unwin stated that he had once made inquiry of a labourer, who at once asserted it to be a maypole. "I did not deny it," said Mr. Unwin, "but I doubted it": and he proceeded to say that it was certainly not a maypole, but a whipping-post, or part of a pillory. It had since been moved, but he did not know by whom. The assertion that Queen Elizabeth slept at the "King's Head"—in the oak-panelled room, the "Chester room"—Mr. Unwin deemed at least probable. The house was built in the time of Henry the Eighth, and as they knew that Queen Elizabeth had hunting-lodges in the neighbourhood he considered it very likely that, if she had not slept she had at any rate paused there to taste the ale or the sack. It was also added that the earliest date in the existing register of the church is 1555.

Mr. A. Lister, F.L.S., and the President having thanked the author for his interesting paper, a short walk across the fields (still somewhat damp from the recent rains) led the members of the party to Oakhurst, where they were warmly welcomed by Mr. and Mrs. Wilson. A large collection

of engravings, water-colour drawings, &c., were there shown by Mr. Unwin, to illustrate his remarks at the church. They all related to the scenes and mansions in the neighbourhood of Chigwell, and included two or three of the magnificent Fairlop Oak to which the eccentric bookmaker, John Day—the author of ‘Sandford and Merton,’ by the bye—paid so many pilgrimages. One of them was very curious, being a lithograph on India-paper and dated 1811—some half-dozen years earlier than the date at which Mr. Ackermann introduced the art from Germany into England, where, however, it had partially become known before Ackermann made its employment general. Mr. Unwin’s portfolio also contained a number of old maps of Essex, and old coaching road maps, in which the existence of “a smith’s shop” was always carefully denoted. One of the maps of Essex was a German map of about the year 1600. On the back of it was part of the account of Essex, in German, and it was curious to note the geographer’s description of Leyton as at that time a small village, five miles from London, and consisting of a few houses strewed here and there. Mr. Oxley, Mr. Letchford, and Mr. Saville Kent showed several forms of microscopic life under the microscope, being the results of the various “dippings” taken during the afternoon; but the finds were meagre, compared with the hauls to be expected at the hands of these experienced pond-hunters on favourable occasions. The specimens exhibited, however, served to illustrate several points in Mr. Kent’s paper.

After tea an Ordinary Meeting (the seventeenth) was held, the President in the chair. The following were elected members of the Club:—Miss Jessie Combs, Prof. Gardner, M.A., F.S.A. (Disney Professor of Archæology, Cambridge), Rev. E. Stanway Jackson, W. T. Latter, Mus. B., R.A.M., Mrs. Meldola, G. R. Noble, G. T. Read, W. J. Clumes Ross, B. Sc., Henry Stear, M.R.C.S., Griffiths Smith, F.R.G.S., E. T. Stringer, George Unwin, P. W. Wall, M. Inst. C.E., F.G.S., T. Westhorp, Mrs. Lewis Winter, and Rev. A. B. Bingham Wright, M.A.

Mr. Saville Kent then read his paper entitled, “Infusoria: What are they? Their Collection and Investigation” [Transactions, ii., 44]. The paper was amply illustrated by figures of the various forms noticed, and a hearty vote of thanks was given to the author by acclamation. A short discussion ensued on some points springing out of the paper, in which the President, Mr. Henry Walker, and the author took part.

The President announced, amid much applause, that the work of excavation at Ambresbury Banks had been performed, and entered into some details of the results obtained. He then said that he had a very pleasing duty to perform, and that was to call upon the members of the Club to return their very warmest thanks to their excellent Vice-President, the Rev. W. Linton Wilson, and to Mrs. Wilson, for their very hospitable and kind reception of the Society that afternoon. (Loud cheers.)

The Rev. W. Linton Wilson said that he was sure the members of the Club already knew that it was his and Mrs. Wilson’s greatest pleasure to receive them that day. He concluded by saying that, seeing Mr.

English leave, he had gone after him, and found that he had a box in his pocket—Mr. English was never without a box—(laughter)—and he had it there. It contained—preserved by Mr. English's wonderful method—a specimen of the Bird's-nest Orchis (*Neottia nidus-avis*) from Epping Forest, and some plants of the Water Crowfoot, concerning which Mr. English communicated the following note:—

“I have a little incident to bring before you, relating to a condition or adaptation of plant-life. The fact has in all probability been observed before, although not generally known, but may be of interest to the young botanist.

“The usual habitat of the Water-Crowfoot (*Ranunculus aquatilis*) is, as its name implies, in pools of water, where its moss-like foliage grows submerged during the greater part of the year. In the spring it grows up to the surface of the water, produces its lobed floating leaves, white flowers, and perfects its head or fruit of beaked achenes. This is the normal condition of the plant. But in a dry season, such as we have just passed through, the pools of water often partially dry up, depriving the crowfoots of the necessary conditions for the development of their secondary lobed floating leaves. Under these circumstances, however, the plants frequently produce flowers and fruit springing direct from the moss-like submerged foliage, an incident which never happens when the Batrachian *Ranunculi* are growing in their usual stations surrounded by water. When heavy rains occur, the specimens begin to throw up their lobed leaves, and rapidly assume the normal characters of the species. I exhibit specimens showing the variations above described.”

The President said he was sure they would welcome short notes like that of Mr. English's with great pleasure, especially when accompanied, as that was, with specimens of the objects described. The abnormal condition pointed out appeared to be of considerable interest. He then asked the Club to record its thanks to Mr. Fisher Unwin for the very able paper read that afternoon.

Mr. Unwin, in acknowledging the hearty vote of thanks accorded, said it had been a pleasure to him to write the paper at the request of their Secretary. He thought that a society which had its head-quarters in the parish of Chigwell, and was visiting the village of Chigwell, ought to have the history of the place told. He regretted that he had so short a time, that it was necessarily a meagre epitome. He trusted that the members would look it up for themselves, for there was a great deal yet to be told, and he would be glad to have information sent to him. He thought the history of Buckhurst Hill might be worked at with advantage.

Mr. Fletcher, President of the Ottawa (Canada) Field Club, thanked the Club for the welcome which it had extended to himself during his stay in the old country, and the President having appropriately replied, the proceedings of a very pleasant meeting—despite the dulness of the weather—came to an end.

THURSDAY, JULY 21ST, 1881.—FIELD MEETING.

A *r union* of the Club was held on this day in Epping Forest, for the purpose of meeting the members of the Hertfordshire Natural History Society, and showing them some of the most interesting features of the Essex woodlands. The weather was charming, but, owing partly to the day of meeting being an inconvenient one for city men, and partly to the fact that many members of both Societies were away from home, the attendance was not so large as is usual on these occasions. The presence and assistance of two well-known naturalists had been hoped for, but professional engagements prevented their attendance at the last moment. About forty members of the two societies were present, including several ladies. The members of the Hertfordshire Club came by train from their county town to Waltham Abbey, and thence by coach to the "Wake Arms," the appointed rendezvous, under the conduct of one of the Secretaries, Lieut. Croft, R.N., F.L.S., arriving about one o'clock. Our own members reached the spot in detachments, some strolling over through the woods from the various forest villages, and others took train to Theydon Bois, and rode or walked up to the "Wake Arms." After pleasant greetings and a hasty luncheon, the united parties made for Monk's Woods, stopping occasionally to botanize, to examine and determine some doubtful insect, or to fish up in little bottles the microscopic inhabitants of the forest ponds and ditches. The late rain and the bright glint of the sunshine enhanced the fresh beauty of the beechwoods, and many were the expressions of pleasure and surprise from those who thus made their first acquaintance with the Forest. Although our looked-for experts were unable to attend, we were not without skilled assistance; indeed we had with us some very good observers, and the flora and fauna of the woods were fairly well investigated during our somewhat hurried peregrinations. The Hertfordshire contingent had with them their well-known botanical member, Mr. Bates Blow, while the Microzoa and Protophyta were registered by Mr. T. W. Phillips. With our Club were several amateur entomologists and botanists, and our visitor, Mr. James J. King (representing the Glasgow Natural History Society) was very busy among his own particular pets—the *Neuroptera*. In Monk's Woods the beautiful rose willow (*Epilobium angustifolium*) was gladly welcomed in full bloom as an old friend, and the abundance of the "stag's-horn" club-moss (*Lycopodium clavatum*) struck many of our visitors as a notable circumstance. In boggy places were seen that favourite of the biologist, the carnivorous *Drosera*, and the pretty *Anagallis tenella* (bog pimpernel); whilst in shady places the little bell-flower (*Campanula hederacea*) lifted its heart-shaped leaves and delicate blue corollas from its damp bed of *Sphagnum* moss. By one large pond, near High Beach, grew the two bullrushes (*Typha latifolia* and *angustifolia*), and in the pond itself were found several species of *Chara*, notably *Chara translucens*. Here Mr. Phillips

recorded the following low forms of vegetal life as the result of his dippings:—*Alonæ*, *Pediastrum biradiatum* and species of *Spirogyra*; *Desmids*, *Closterium lunula* and others; *Diatoms*, *Meridion circulare* (abundant), *Synedra ulna*, *S. capitata*, *Navicula serians*, *N. crassinervia*, *Gomphonema stipitatum*, and *Fragillaria striatula*. In the woods the entomologists were much astonished at the extreme abundance of the yellow-underwing moth (*Triphæna pronuba*). Literally hundreds of these common but very handsome moths were disturbed as the party wandered through the woods, the insects taking a sharp flight of a few yards, flashing out a gleam of colour and then settling again, their dull mottled fore-wings concealing the gayer tints, and so rendering their detection amongst the greys and browns of the dead leaves and mosses a very difficult task.

The usual butterflies of the Forest were often noticed. By way of a sample, Mr. Lockyer netted a lovely fresh *Gonepteryx Rhamni*, *Satyrus Egeria*, and a curious dark form of *Polyommatus phleas*. Flitting about us were to be seen the "gatekeeper" (*Satyrus Tithonus*), common "blues," and in the sedgy open places in the woods the "common skipper" (*Hesperia linea*) was in great abundance.

Mr. King's take of Neuroptera was somewhat extensive, and the list is given entire, so little having been done in this direction in Epping Forest:—

Psocus longicornis, Fab. Very common, occurring on the oaks.

P. variegatus, Fab.

Stenopsocus immaculatus, Ste. Very common.

S. cruciatus, Linn. Common.

Cæcilius fuscopterus, Latr.

Peripsocus phæopterus, Ste. Not uncommon.

Elipsocus unipunctatus, Müll. Very common.

E. hyalinus, Ste. Very common.

Cleon dipterum, Linn.

Platetrum depressum, Linn. Common.

Æschna cyanea, Müll. Common.

Æ. grandis, Linn. Very common.

Pyrrhosoma minium, Harr. Very common.

Agrion cyathigerum, Charp. Very common.

Sisyra fuscata, Fab. Occurred near Loughton.

Hemerobius elegans, Ste., var. *Marsami*, Ste. Obtained by beating

the bushes that skirted a pond near Loughton.

Hemerobius micans, Oliv. Very common all over the Forest. The var. *fuscinervis*, Schn., also occurred.

H. Humuli, Linn. Common.

Chrysopa alba, Linn. Constantly being beaten out of the bushes, &c.

C. aspersa, Weism. Uncommon.

C. ventralis, Cur. Uncommon.

Coniopteryx Tineiformis, Cur.

C. aleyrodiformis, Ste.

Panorpa communis, Linn. Common.

P. Germanica, Linn. Common.

Grammotaulius atomarius, Müll. One specimen occurred at a ditch near High Beach.

Limnophilus affinis, Cur. Not uncommon.

L. centralis. Occurred everywhere.

L. sparsus. Very common.

Mr. Phillips was the only member of the party who diligently collected Microzoa, but he reported that the forest-ponds were very productive, especially near High Beach. His list of the contents of his bottles and tubes is as follows:—

Stenior niger.
Melicerta ringens.
Vaginicola crystallina.
Cothurnia imberbis.
Trachelius olor.
Arcella vulgaris.
Candona lucens.
Brachionus pala.
B. urceolaris.

Metopidia sp.? (no gizzard visible,
 possibly a male of *M. lepadella*).
Euplotes patella.
Coleps hirtus.
Actinophrys Sol.
Euglena viridis.
E. acus.
Phacus triquetra.
Pandorina morum.

High Beach having been visited, and the view over the valley of the Lea into Hertfordshire and Middlesex duly enjoyed, the whistle was vigorously sounded to gather together the dissociated elements of the party; and a delightful ramble through tangled brake and thicket brought the members to our ancient Camp, where Mr. Cole pointed out and explained the recent excavations and their results. After a thorough inspection of the site of the Camp, the return signal led the party back to the "Wake Arms," where a substantial "high tea" awaited us. Time did not permit of much talk. The Rev. W. Linton Wilson, M.A., took the chair, and in a genial speech cordially welcomed our Hertfordshire colleagues. Lieut. Croft, F.L.S., as Secretary of the Herts Club, expressed the pleasure of his members at their first incursion into Essex; many had that day seen Epping Forest for the first time, and he was sure they were both surprised and pleased. He hoped this pleasant *r union* of the two societies, so closely united in purpose and constitution, would become an annual affair. The presence of ladies at the meetings was a feature cordially welcomed by both clubs, and he was sure all had reaped the benefit of the regulation in the graceful assistance rendered by their lady members at the tea-tables. Soon after tea the Hertfordshire detachment mounted their coach *en route* for Waltham, and the members of the Essex Club wandered through the woodlands to Loughton and Theydon Bois in the cool calm evening of a perfect summer day.

MONDAY, AUGUST 1ST, 1881.—FROM EPPING TO THEYDON GARNON, ESSEX.

[In the circular announcing the previous Field Meeting it was intimated that "On Bank Holiday some members will meet at Epping Station on the arrival of the 10.13 train from Fenchurch Street, for a country ramble. Those intending to join should communicate with the Secretary." The Secretary and Librarian were duly in attendance, but only three other members put in an appearance. However, this triad included the botanical skill and local knowledge of Prof. Boulger and Mr. English, and a very pleasant and profitable day was spent. The following sketch of the ramble is from Prof. Boulger's notes, supplemented by a few observations by Mr. English and the Secretary.—ED.]

As our small but enthusiastic party left the Epping Station, the first object of botanical interest to attract our notice was the rest-harrow, of

which the spiny variety (*Ononis campestris*) only prevails thereabouts. The common elm at this locality is a remarkably small-leaved form, the leaves on young and vigorous shoots being diminutive; and during the whole day *Quercus pedunculata* was the only form of oak we met with. Plunging into the luxuriant vegetation of a rough sloping bank of wasteland by a green lane we speedily came upon much of interest; quantities of flea-bane (*Pulicaria dysenterica*), meadow-sweet (*Spiraea Ulmaria*) with its characteristic gall, the result of the "house holdings" of a small gall-gnat called *Cecidomyia Ulmariae*, an oak stump with its twigs much affected with both the Devonshire or marble gall (the work of *Cynips Kollari*) and the very curious artichoke gall (*Aphilothrix gemmae*, L., *C. fecundatrix*, Hart.), the result of the distortion of the leaf or flower-bud of the oak by the insect. Other plants noticed were some fine examples of thistles (*Onopordon Acanthium* and *Carduus palustris*), red campion (*Lychnis diurna*), tufted vetch (*Vicia cracca*), willow herbs, and St. John's worts. The handsome teasels (*Dipsacus sylvestris*) with several pairs of connate leaves, forming pitchers crammed with animal matter, suggested some remarks on accidental and purposive structures; whilst as they were just in flower, they also illustrated the artificial nature of the classification of inflorescences into centrifugal (in which the central flower opens first) and centripetal (in which the order of development is the reverse, the lower flowers opening first); in the teasel tribe (*Dipsacaceae*) many examples occur, as in *D. sylvestris*, of a combination of both forms of development. *Convolvulus sepium*, generally preferring cultivated ground, was, however, plentiful, as also was the bittersweet (*Solanum Dulcamara*); whilst in fruit were noted the pepper wort (*Lepidium campestre*), cuckoo-pint (*Arum maculatum*), black bryony (*Tamus communis*), and cleavers (*Galium Aparine*), the abundance of which last afforded a practical exemplification of one mode of seed-dispersal, the curious little rough fruit with its hooked bristles clinging in hundreds to our clothes as we forced our way through the thick herbage. The large compound umbels, hollow or "fistular" stems, and pinnately-divided leaves with large basal sheaths, of fine specimens of *Angelica sylvestris* (suggesting to our entomologists larvæ of *Eupithecia*) and the cow-paranip (*Heracleum Sphondylium*) illustrated the order *Umbelliferae*. We leave the "siding" to pass through Steward's Green, as it is called,—a long green lane, which seems to possess some interest to the entomologist and botanist. Here we encountered the centaury (*Erythraea centaurium*), *Hypericum hirsutum*, and a remarkably small-flowered *Epilobium parviflorum*, which were "bagged" previous to the "interval for refreshment." The bittersweet was luxuriating in a pond by which stood some sycamores, free from the fungus *Phytisma*, and covered with their winged "samaras." The "Theydon Oak," growing by a pond not far from the Inn, is now a mere wreck, and was estimated at twenty-six feet girth and to be *not less* than three centuries in age. The party then plunged into Theydon Garmon or Coopersale Forest, dense with holly and hornbeam, and apparently

part of the ancient Forest of Essex. Hard by was a meadow locality for adder's-tongue (*Ophioglossum*) and *Orchis Morio*, known well to Mr. English, round the borders of which some splendid plants of *Equisetum* were growing. Returning to the Forest, we crossed a bog where the white-rot (*Hydrocotyle vulgare*) abundantly illustrated a departure from the normal foliage of umbelliferous plants, and here a few species of *Fungi* were noted. *Russula vesca*, with its rosy pileus; *Marasmius urens*, a poisonous species with a very pungent odour; *Agaricus fuscipes* and *A. appendiculatus*—common, but welcome when other forms are not to be found. Here also we met with *Stereum purpureum*, an unusual sight at this season of year; usually the plant is only found in perfection during the winter time. Passing onward through a rushy swamp, which in spring is always gay with flowers, notably *Caltha palustris*, we cross the new road to Gayne's Park and enter the fields known as the "Lawns," where in days gone by Mr. English tells us the *larvæ* of the burnet moth (*Zygæna filipendula*) used to swarm, and where at early morn the vagrant cuckoos could be seen feasting on the unsuspecting caterpillars. From the "Lawns" we enter the fine woods, which, although contiguous, are known by the several names of Gaynes Park Woods or "Birchen Copse," Hawk's Hill and Ongar Park Woods. Having previously noted *Bartsia eu-Odontites* and the yellow rattle (*Rhinanthus crista-galli*), we now come upon a third of the semi-parasitic Scrophulariads, the cow-wheat (*Melampyrum pratense*); and in a ditch, then dry, near the site of the "Centre-tree" (now a thing of the past, but the seven rides or "wonts" converging still mark the spot), was abundance of the skull-cap (*Scutellaria galericulata*), with the wood pimpernel and the money-wort (*Lysimachia nemorum* and *Nummularia*). Here Mr. English, from a well-remembered spot, obtained abundance of the rose-bay (*Epilobium angustifolium*), *E. hirsutum*, *E. palustre*, and *E. obscurum* being also noted during the day; whilst their graceful ally, the enchanter's nightshade (*Circæa lutetiana*) was abundant. On the trunks of the oaks we noticed many specimens of the fine moth, the "black arches" (*Liparis monacha*), and one or two of *Epunda viminalis*; whilst among the butterflies the fresh *Gonepteryx Rhamni*, some *Vanessidæ*, "gate-keepers," "blues," and "skippers" were welcomed as very old friends. The alders yielded many specimens of a remarkable stalked gall on the upper side of the leaves, the work of one of the *Phytopi* or gall-mites (perhaps *Cephaloneum pustulatum*, Bremi.); and on the maples were thousands of the reddish leaf-galls of another mite (*Cephaloneum myriadeum*), and the wild roses bore "bedeguars" in abundance. Taking the Epping ride, one of the seven, we descended the hill, noting the fungus *Lactarius piperatus* on the banks, regained the Coopersale Forest, and then made for the gravel-pits. Here *Hottomia palustris*, we were told, had once been common, but had apparently been exterminated by the gravel-digging. But we found a nice *Sphagnum* bog, containing abundance of a plant somewhat rare in South Essex,—*Menyanthes trifoliata*,—the catberry

petals of which will afford a problem in another season for the local Darwinians. Round about was abundance of the historic needle-whin (*Genista Anglica*), and this spot afforded an agreeable finish to the day's botanizing. Among the other plants noticed during the day were, *Achillea ptarmica*, *Hypericum perforatum*, *humifusum*, and *pulchrum*, *Epilobium hirsutum* and *obscurum*, *Geranium dissectum*, the two pretty legume bearers, *Lotus major* and *corniculatus*; and our note-books contained entries of more than one hundred plants. After witnessing the "polo" play on Epping Plain, and examining Mr. English's old-fashioned garden of hardy plants, his preserved *Fungi* and other specimens, we betook ourselves to the station, which we left in a heavy fall of rain and—a somewhat crowded condition.

SATURDAY, AUGUST 13TH, 1881.—FIELD MEETING AND ORDINARY MEETING.

A VISIT TO CHELMSFORD AND DANBURY.*

It afforded the Council great pleasure to hold a Field Meeting in conjunction with the subscribers to the "Essex and Chelmsford Museum," as tending to promote those feelings of good-fellowship and mutual encouragement which should prevail between societies having objects so much in common—the diffusion of a taste for the study of Science and increasing the opportunities for intellectual recreation in the county. Mr. Edmund Durrant, Hon. Secretary to the "Museum," took great interest in the affair, and to his kind exertions much of the success of the meeting was due.

The weather was not so genial as could be wished. On the Friday preceding the meeting the rain came down heavily all day, and made the prospect of Saturday anything but cheering. Saturday itself opened dull and threatening, and later on it fulfilled its threat by an occasional shower, which, however, did very little to disturb the day's enjoyment. Still it was a chilly day, and the lowering skies did not show the country at its best. The untoward weather had the effect of keeping at home a great many members of the Essex Field Club who would otherwise have gone to Chelmsford, but, nevertheless, a fair number assembled at Liverpool Street Station in the morning, and went down to the county-town by the 10 a.m. express train. The Club was for the first time enabled to take advantage of the concession of the Directors of the Great Eastern Railway Company, by which members are allowed to purchase a return-ticket at a single fare from the Liverpool Street, Buckhurst Hill, Woodford, or Stratford Stations, to any given station on the railway in

* The Proprietors of the 'Essex Times,' the 'Essex Weekly News,' the 'Chelmsford Chronicle,' and the 'Essex Herald' sent representatives to this Meeting, and the several newspapers for the week ending August 20th contained lengthy and excellent reports of the same. The two first-mentioned papers printed Mr. Chancellor's memoir *in extenso*. —Ed.

the neighbourhood of which the Club might from time to time hold either Field or Ordinary Meetings.

On reaching Chelmsford a move was quickly made to the "Saracen's Head Hotel," in the High Street, the appointed head-quarters for the day. After a short stay there, and not a few pleasant introductions and handshakings, the company—now considerably augmented by fresh local arrivals—proceeded across the road to St. Mary's Church, Mr. F. Chancellor (Architect to the Diocese),—who, thanks to a long and loving study of its architectural and antiquarian details, is perhaps better qualified for the task than any other man in Essex,—having kindly undertaken to act as their "guide, philosopher, and friend," in connection with the inspection of that ancient and stately edifice. Taking his stand under one of the noble arches of the tower, Mr. Chancellor read an elaborate paper upon the Church, giving its history from 1424 up to the present time, and lucidly explaining its architectural features and its points of historical and antiquarian interest. We much regret that the limits of these reports, and the scheme of the Club as mainly a Natural History Society, precludes the insertion of this valuable paper in its entirety. Mr. Chancellor began by referring to the very meagre records of the ancient history of Chelmsford. There could be no doubt that a Church existed there from very early times, and it might fairly be presumed that the structure was one of some importance; but, except what might have been used in the shape of old materials in the building of the walls of the present edifice, no remains of it are extant. Doubtless the old Church, which partook probably of the Norman character, was utterly annihilated by the townsfolk when they determined upon re-building of their parish Church in 1424. That John De Vere, twelfth Earl of Oxford, whose family was possessed of the "Old Black Boy," and who probably made Chelmsford a halting-place and an occasional residence in his journeys to and from Hedingham Castle to London, aided in the work of rebuilding the Church, was proved by the fact of his shield, charged with the mullet, being carved in the spandril of the west door of the tower, and by his crest, the boar, being introduced in the apex of the arch of the same door. This latter corresponded with the carved boar which formed part of the ceiling of an apartment in the "Old Black Boy." The Bouchiers, the Mountneys of Mountnessing, the Beauchamps, the Nevilles, the Mowbrays, and the Warners of Great Waltham, all undoubtedly contributed to the re-edification of the building, for their arms decorated the roof, and were emblazoned in the east window. Although all that remained of the old structure was the tower, the south porch, and a few other fragments in the aisles and chancel, they were sufficient to prove the care taken in its building. The tower was one of the strongest and most enduring pieces of workmanship in the district. It had withstood the storms of four centuries with scarcely an impression made upon its massive walls, and, unless damaged accidentally or wantonly, it would last for as many centuries more. In 1424 the Perpendicular style had

established itself throughout the country, and the new edifice was erected wholly in that style; and although some of the details were poor and somewhat debased, there was still an air of magnificence about the old tower which was sufficient of itself to stamp its architect as a master of his art.

Mr. Chancellor gave a minute description of the tower as it was left by its architect in 1424, but in 1749 misfortune came; the sapient townsmen thought that the effect of the whole building would be increased by a spire, and that wretched apology for one which still crowned and disfigured the tower was erected.

After speaking of the bells and reproducing the quaint poetical inscriptions upon them, Mr. Chancellor said that, next to the tower, the south porch demanded attention. Consisting of two stories, it was a more imposing feature than usual; the room over it had for many years been utilized as a depository for wills, and probably had always been used for the transaction of ecclesiastical business. It now contained the library left by the late Dr. Knightsbridge. The external appearance of the porch was at present destroyed by the "abominably hideous projection containing the staircase." A highly-enriched niche, which probably contained a sculptural representation of the crucifixion, surmounted the archway. The body of the Church, consisting of the nave and aisles, was almost totally destroyed in 1800, when the roof fell in, and but a few fragments remained of the original work. The plan of this part of the structure was the same as at present, except the recent additions of the north aisle and transept, as the new walls were erected upon the old foundations, such parts of the old structure as were sound being worked into the new edifice. The arches were doubtless the same as at present, but they carried a clerestory of a very imposing character. The west end of the north aisle was the most important fragment left of this portion of the building of 1424. Fortunately the roof remained and served as a key to that of the nave. The noble effect of even these few fragments compelled them to pause and endeavour to realise the grandeur of the old structure in its original glory, with its massive oaken roof spanning both the nave and aisles, enriched undoubtedly with shields and banners in all the tintings of heraldry, and possibly with its mouldings revelling in a sea of gold and red and blue. A noble clerestory enriched with painted glass lighted up the whole building, bringing out by the reflected lights the depths and shadows of the old oak framing, the lofty arches of the tower forming a fitting entrance to the goodly structure, and the long vista terminating in the richly-painted window of the chancel.

On the 17th of January, 1800, the whole of the roof fell with a tremendous crash, carrying with it the greater part of the nave-walls, and rendering necessary a re-edification of nearly the whole of the structure. For this purpose it appears an Act of Parliament was required. The inhabitants, as in 1424, set to work in good earnest—would that their zeal had been better rewarded; but unfortunately at that time Gothic

architecture was not appreciated, its beauties were ignored by those who ought to have upheld them, and he could not endorse the opinion of a recent historian who said that the present Church was "a monument of liberality and taste." The liberality of the inhabitants was undoubted, and was well worthy of emulation, but the taste in which the work was executed was most questionable.

For three hundred years,—extending from the commencement of the 16th to the commencement of the 19th century,—although surrounded by the most exquisite examples, our ancestors appeared to have been insensible to the charms of Gothic architecture, and to have ridiculed it in every conceivable manner; brighter days had dawned upon them, and Gothic architecture, like a Phoenix, had risen from her ashes and was re-asserting her power over the length and breadth of the land.

The monuments in a Parish Church frequently form the chief materials for the history of the place; and in the small and unpretending Village Church, where the surrounding lands have passed from father to son for generations, we find the most magnificent specimens of these memorials; but in a town, where exchange of property is more frequent and where the family monuments are left without natural protectors, they are destroyed or mutilated without remorse. Considering the wealth and power of the neighbouring lords, there could be no doubt that formerly many memorials existed of those who once held sway over the district, but they were all gone, and three brassless stones alone remained as representatives of the early monumental history of the fabric. The oldest monument was that to Thomas Mildmay, of the date of 1571, which bears a very quaint Latin inscription. Upon one of the walls of the north chancel aisle was an interesting inscription on a brass tablet, compiled, he believed, by the late Archdeacon Mildmay, which set forth the names of those members of the Mildmay family who lay buried either in the old Mildmay vault or in the precincts of the Church, together with the dates of the burials. Mr. Chancellor referred to the improvements which had been effected since 1867 in the removal of the galleries; the addition of a second north aisle and the north transept; the remodelling of the chancel by the construction of a new east window; the addition of a clerestory and new roof; and concluded by saying that the party had travelled round, over, and he might almost say under the Church, and he believed that he had directed attention to every part of it to which any interest was attached. Hidden from view in the walls of the Church itself, or on the bookshelves of great public libraries, much information might still exist, and if any person would undertake the task of thoroughly searching old records and volumes, many curious facts might be discovered, and much light thrown upon the character of the original structure, at the existence of which he had only been able to glance.

The paper was listened to with great interest and attention throughout, and after a thorough inspection of the Church—not forgetting the remains of the Knightsbridge library, now fast hastening to decay by reason of

neglect, vermin and damp—the company walked to the Museum in Bridge Street, under the guidance of the Rev. B. E. Bartlett, M.A., the Honorary Curator, and Mr. Edmund Durrant, the Honorary Secretary. The Museum contains some interesting objects, notably a general collection of shells and specimens of Roman and other pottery found in Essex. But the paucity of local specimens, and the absence of proper labels, detract very much from the value of the contents of the Museum. Mr. Bartlett gave a brief but interesting sketch of the history of the institution, and did all in his power to render the visit a pleasurable one.

Many of the Members of the Club were most hospitably entertained at luncheon by Messrs. Durrant, Chancellor, Baker, and other townsfolk. About half-past one o'clock there was again a gathering at the "Saracen's Head," from whence the party was carried in drags and other conveyances through pleasant lanes and by smiling corn-fields, past Great Baddow and Sandon, over Wood-hill, and so to the Bishop's Park. As we rode through Great Baddow, attention was called to the fine "Copper Beeches" (*Fagus sylvatica* var. *purpurea*), in one of the park-like gardens. Tall plants of *Typha angustifolia* were espied in a pond by the roadside, and the spectacle of large patches of the handsome *Lythrum Salicaria* gave rise to a discussion on the tri-morphism in the structure of the flower of that plant, which was so thoroughly investigated by Darwin. Mr. John Gibbs (a well-known Chelmsford botanist) remarked that he was sure he had found all the three forms in his own neighbourhood.*

At Sandon a short halt was made to give an opportunity for the inspection of the quaint little Church of St. Andrew, which is believed to be of great antiquity. Here were some gigantic elms by the Church gate—a row of massive and venerable trees that have skirted "God's-acre" for centuries. One fine pollarded specimen (*Ulmus campestris*, With., var. *vulgatissima*, Miller) was measured by Professor Boulger, and found to

* On September 3rd, Mr. Gibbs wrote:—"On Monday last I took a walk in search of *Lythrum Salicaria*, and in a ditch bordering a lane between Chelmsford and Writtle, I gathered 88 twigs from different plants. On examining them, I found 13 long-styled, 16 mid-styled, and 5 short-styled, so that I was not after all in error when I said that all three forms are to be found near Chelmsford."

Mr. Gibbs has also handed to the Editor a list of native flowering plants, observed by himself in the neighbourhood of Chelmsford, 874 in number, which will best form the subject of a separate communication. He remarks that "the list does not include several plants, natives of other parts of England, and in cultivation here, as lucerne (*Medicago sativa*). *Tragopogon porrifolius* is only found on the banks of railways, to which places the winged monospermous fruits are believed to have been conveyed by wind. Several species included in my list may have been destroyed by the removal of woods, of which many acres have been cleared since I observed *Epilobium angustifolium* and *Paris quadrifolia* growing in them. There are, however, many plants not included, especially Cyperaceae, and probably several species of *Potamogeton*. *Gnauthe Phellandrium* has been very luxuriant this year in ponds and ditches near Chelmsford, and being a very poisonous Umbellifer it may possibly cause the death of cattle, who are not botanists enough to distinguish it from the Water Paramep, when taken from ponds and left upon the land by men who are not better botanists than the cattle."—ED.

have a circumference of more than 20 feet. In the fissures of the brickwork of the Church, the pretty ivy-leaved toadflax (*Linaria Cymbalaria*) grew freely. Springing from the tower above us was a tree (which the villagers declare to be an elder), probably the result of the growth of a seed conveyed thither by a bird.

The chief features of interest in the Church were pointed out by Mr. Chancellor. It contains a remarkably perfect pulpit, dating from the time of Henry the Eighth. In design and execution it is like a very fine example of perpendicular work, and of it Mr. Chancellor remarked that he did not know of another in Essex which was so perfect, so complete, and in design so beautiful. The chancel arch came in for a great deal of notice. It is evident that a narrower chancel arch at one time existed,—probably Norman,—and it is well known that the Norman chancel arches in Essex churches were often very narrow. The present arch has been formed by cutting away the narrower arch and so enlarging it. Over the centre, facing the altar, is a curious arched recess, the purpose of which was not explained, though it looks as if it had been intended to hold an image. A few words were also devoted to the small pieces of coloured glass inserted in the east window, which Mr. Chancellor deemed to be probably original, and attention was called to the centre shield, bearing the device of the St. Clere family, monuments of whom are in Danbury Church. Greater interest still was shown when the speaker directed attention to what is known as a “leper window,” or “low side window,” as to the purposes of which archaeologists are divided. One theory is that these windows were contrived to allow of the administration of the Sacrament to the lepers, who were not allowed inside the church. Another is that they were intended to permit the sacristan to hold the bell outside and ring it at the consecration of the elements, to convey to the village information of the performance of the rite. The point was freely discussed at a late meeting of the Essex Archaeological Society, and is yet far from settled. Mr. Chancellor described the tower of the church as a very fine specimen of the many brick towers constructed in this county in the time of Henry the Seventh and Henry the Eighth. And he added, in words that would make the builders of to-day blush, if a man with the power to blush could be a nineteenth-century builder, that the brickwork was extremely good, “as all the brickwork of *that* time was.” Attention was also called to some curious mural brasses, one of them with the date obliterated, bearing a quaint inscription to the memory of “Patrick Hearn Clark, late parson of this pariah of Sandon.”

Leaving Sandon, the party followed the road which winds up the Danbury heights, through charming country, the prospect of which widened as the elevation increased, giving fine glimpses of sylvan scenery. Mr. Gibbs pointed out a bank by the roadside, on the rising ground quitting Sandon, as a station for *Claytonia perfoliata*, Don, a North American plant, sometimes found in a semi-wild state. Mr. Gibbs states, “It was in May, 1858, that my friend, the late Mr. Edward

Copland told me that his son, who was then ill and soon afterwards died, had found such a plant in the previous August. I therefore went in search of it and found it in the place where it has grown ever since. As Mr. Copland flattered himself that he had made an addition by his discovery to our list of native plants, I never told him what I afterwards learned from the cottager who occupied the garden bounded by the hedge under which this interesting plant grows:—that the Bishop's gardener had given him some seeds of American annuals which he sowed, and that the *Claytonia* in particular had overrun the ground and finally established itself by the wayside."

Arriving at the Bishop's Park at Wood-hill, the "traps" were dismissed with instructions to the drivers to "wait at the 'Griffin'" until the afternoon's ramble was over. With great courtesy the Bishop of St. Alban's had readily accorded permission to the members to stroll through a portion of the park, at the same time expressing his regret that the fact of his daughter's marriage with the Duke of Argyll taking place on that day would prevent him from having the pleasure of offering them the hospitality of the Palace. The saunter through the grandly timbered park with its picturesque clumps of oak, beech, and elm, its glades and avenues and charming pieces of ornamental water, was thoroughly enjoyed by all. In the ponds were noticed the white water-lily (*Nymphaea alba*), *Myosotis palustris*, *Mentha hirsuta*, the graceful *Alisma Plantago*, and the deliciously fragrant sweet-flag (*Acorus Calamus*). Mr. Jaggs, the park-keeper, called attention to a fine oak tree (*Q. pedunculata*), with leaves curiously variegated, but bearing acorns invariably producing normal plants. Professor Boulger (who acted throughout the afternoon as "botanical conductor," and of whom it was good-humouredly asserted by one of the party that, in the language of the motto to 'Notes and Queries,' he proved himself the most "learned, chatty, and useful" of guides) was disposed to attribute the variation to the presence of a parasitic Alga in the cells of the leaves. The variation is contagious but not hereditary in some ivies, and regret was expressed that the tree did not stand in the midst of a grove of oaks, in order that it might be seen whether the disease would be communicated to them. Near this was a small slip of willow brought by Mrs. Campbell from the tomb of Napoleon I., at St. Helena, and now growing healthily and vigorously in the Essex park. In the walk through the woods several other interesting plants were noticed, particularly *Ruscus aculeatus*, the only British monocotyledon with a woody stem; this also grows on Danbury Common and at Little Baddow, so plentifully as to leave no doubt as to its being a true native. Piloted by Mr. T. M. Gepp, who appeared to be familiar with every inch of the ground, the party made its way through the woods, halting to be let through a gate here, and having to clamber over a fence there, from the park to

"The decent Church that tops the neighbouring hill,"
which is built within the bounds of the ancient camp. This is one of the

highest points in Essex, and from it a magnificent view was obtained in all directions over the surrounding country. Several of the gentlemen of the party ascended the tower, the scene from which amply repaid the awkwardness of a part of the climb—that through the belfry, to wit, which might well dismay unpractised climbers. The air was not too clear, and the mist hid some of the more distant points, only lifting a little to allow of a perplexing uncertain glimpse, and then closing and blotting all out. But though bright sunshine would doubtless have made the prospect much grander, it was yet a very fine one. In the distance was the town of Maldon, and southwards lines of light showed the course of the river Crouch and the mouth of the Thames, and those visitors whose acquaintance with Essex and its many scenic beauties was limited, were charmed with the outlook and were even ready to admit how little the county deserves the commonly bestowed stigma of tameness.

In the building itself Mr. Chancellor's descriptive powers and architectural lore were again called into requisition to amuse and instruct the visitors. Danbury Church, dedicated to St. John the Baptist, contains, as was pointed out to the visitors, memorials of the days of the Crusaders not to be exceeded, it is said, by any others of the kind in the kingdom, not even by those in the Temple Church. The carved benches and stalls in the chancel, and the beautiful stone altar screen, are the work of the modern artificer on the occasion of the restoration of the Church some years ago; but the piscina and part of the sedilia speak of ancient days, and portions of the building are of very old date. The building has been twice injured by lightning, once in 1402, concerning which Hollingahed states in his '*Devil of Danbury*'—"Vpon *Corpus Christi* day, in the yeare 1402, the third of Henry the Fourth, at evensong time, the Devill entred into this Church, in the likeness of a Gray frier, and raged horribly, playing his parts like a Devill indeed, to the great astonishment and fear of the parishioners; and the same houre with a tempest of whirlewind and thunder, the top of the steeple was broken downe, and halfe of the chancel scattered abroad." And again, on 5th February, 1749-50, lightning struck fire to the spire and about 20 feet of it was burnt. Under low arches in the walls of the aisles are three recumbent figures of cross-legged knights carved in wood, which are undoubtedly effigies of three crusaders of the St. Clere family, the former lords of the parish. The feet of each figure are supported by a lion, and every lion and every man is in a different position—a fact which is considered by certain learned antiquarians to be emblematic of the manner of their deaths. The crossed legs of the effigies go to show that the warriors whom they represent were crusaders of the days of Richard I. The body of one of these crusaders was discovered about 100 years ago by some workmen who were digging a grave. It was encased in a leaden shell with two outer coffins, and was found to be in a good state of preservation, this being due to the influence of a liquor in which it was lying.

Leaving the Church, an inspection was made of the ancient camp,

under the direction of Mr. E. Corder. Nothing definite can be gleaned from the pages of local historians as to the date or intention of this earthwork. There is a rude plan of the camp in Morant's 'History of Essex,' but very few details are given, and even local tradition is almost silent, a vague notion that it is a military fortification of some kind only obtaining in the district, and apparently some people admit feeling a certain amount of scepticism as to its being a camp at all! But there can be little doubt upon that point—in more than one place the form of the rampart is abundantly evident, and the glacis well-defined. In the absence of careful surveys and measurements, and a scientific exploration of the ramparts themselves, it would not be wise to hazard any statement with respect to the probable date of the work. It is evidently well worthy of study, and it is very desirable that some effort should be made to clear up the doubts which attach to it.

Time did not admit of any extended "prospecting" in the neighbourhood by the naturalists of the party. Danbury seems to be as well fitted as any place in Essex for the researches of the biologist. Mr. Corder stated that the park is a good place for birds, and that they are not disturbed. The old trees harbour Brown and Barn Owls, Green Woodpeckers and Nuthatches. Hawfinches build in the park and other wooded parts of Danbury Hill. Mr. W. D. Cansdale, then residing at Witham, who was of the party, stated that "although from an entomological point of view Danbury might not be entitled to rank on an equality with other insect hunting-grounds in the county, yet the large number of species that have been taken there from time to time sufficiently indicate that if well-worked the district would prove to be a very productive one. The parish is well studded with woodland, with several commons, in and through which the entomologist can thread his way with tolerable ease. The underwood consists principally of oak, hornbeam and birch, with a fair supply of willow. The wild *Clematis* is plentiful, a certain guarantee that many species may be found which are seldom met with in districts where that plant does not occur."

The visitors noticed the pretty cornfield alien, *Geranium pyrenaicum*, in the hedgerows, and *Verbena officinalis* (the favourite plant of the Druids), found bordering the pathway near Danbury Church, was jokingly put forward as an evidence of the British origin of the camp. *Bryonia dioica* in fruit was a conspicuous object in the hedges. Professor Boulger, who has made a special study of our native elms, pointed out *Ulmus montana*, Smith, var. *nitida*, Syme, on the second line of "ramparts." Mr. Corder alluded to some interesting plants known as occurring in the neighbourhood. On the commons he said were to be found *Drosera rotundifolia* and the bog pimpernel (*Anagallis tenella*), and that in a certain spot grew a few plants of the pretty maiden pink (*Dianthus deltoides*) which appears not to be found wild elsewhere in Essex.* On Woodham Walter Common ferns

* Gibson in the 'Flora,' gives only one station—"on a wall at Witham, probably an escape. This is truly wild at Hildersham (Cambridge), beyond the borders of this county, but has not yet been so found in Essex."—ED.

are numerous. *Osmunda* was once abundant but is now probably extinct. *Nephrodium* (*Lastrea*) *Thelypteris*, *Convallaria majalis*, *Erica Tetralix*, and alders and buckthorns also grow there.

Halting at a field gate on the way back to the "Griffin," Professor Boulger read a paper "On the Origin and Distribution of the British Flora" [Transactions, ii. 69]. A very cordial and unanimous response was made to the request of the President, seconded by Mr. H. Walker, that thanks should be voted to the author for his admirable essay.

Much regret was felt that time would not admit of a visit to Sir Brook Bridges' woods, permission and facilities to visit which were kindly given by Mr. T. M. Gepp.

Upon returning to Chelmsford at about six o'clock, the company sat down at the "Saracen's Head," to one of the "high teas" now so well known to members, admirably served by Mr. Fuller.

At the close of the repast Mr. Meldola proposed, in a few well-chosen words, votes of thanks to those who, by their kind aid, had so much enhanced the success of the meeting:—to the Bishop of St. Albans, the Rev. R. E. Bartlet, Mr. E. Durrant, Mr. Chancellor, Rev. T. P. Bridges, Rev. S. T. Gibson, Mr. Gepp, Professor Boulger, Mr. H. Corder, and others who had in various ways given valuable assistance. He was very glad on the present occasion to see that they had among them so large a number of their colleagues of the "Chelmsford Museum," and he hoped that this mutual arrangement might hold good for many future meetings. At the same time they must not forget to return their most cordial thanks to those members of the Museum who had been good enough to receive and entertain them in the very kind and hospitable manner they had done that day. [Applause].

Mr. John Spiller, F.C.S., said, as that was the first occasion on which the members of the Essex Field Club had been able to come and go by rail on easier terms than usual, he should like to include among those to whom votes of thanks were given the Directors of the Great Eastern Railway Company. [Hear, hear.] As a Londoner he was glad to find that the Great Eastern Railway Company had, so to speak, recognised the Society, and that its members would, in future, be able to travel by rail to their various meetings on more advantageous terms than persons who were not interested in scientific pursuits. About three weeks ago a Deputation, of whom he was one, waited on the Directors, and were most kindly received by Mr. Parkes, the Chairman, and when he had heard what they had to urge on behalf of this, their local scientific Society, he, on behalf of the Directors was good enough to accord them the privilege they asked for. He thought, therefore, that when they were passing these votes of thanks they should include in them thanks to the Chairman and Directors of the Great Eastern Railway for the concession they had granted them. [Hear, hear.]

The votes of thanks having been carried by acclamation, Mr. Durrant briefly responded on behalf of the Museum, assuring the members of the

Field Club that it had been a very great pleasure to the members of the Museum to welcome them in that town. [Applause.]

Mr. Chancellor said he was exceedingly obliged to them for the kind vote of thanks they had passed to him. All he could say was that it had been to him a labour of love, and it had been a great pleasure to him to meet the gentlemen belonging to a Club which was considered, perhaps, to trench somewhat on the manor of the Essex Archæological Society. He had been on the Council of the Archæological Society since it started, and he could only say he was very pleased to welcome fresh labourers. Essex had been somewhat barren of archæologists. He did not care whether they came from inside or outside their Archæological Society, and he was pleased at all times to forward their views, and to explain, as far as his information would allow him, anything that came in his way. [Applause.]

The meeting then resolved itself into the Eighteenth Ordinary Meeting of the Club, the President taking the Chair.

The following were elected members:—W. Wakeling Boreham, J.P., F.R.A.S., Edward Brown, Rev. L. Cockerell, M.A., Edmund Durrant, (Hon. Sec. Essex and Chelmsford Museum), Frank L. Emanuel, F. H. Forward, G. W. Gould, G. T. Jones, M.D., &c., G. Alan Lowndes, J.P., D.L., &c., D. H. Neale, Henry Spicer, B.A., F.L.S., F.G.S., Mrs. S. Warburg.

The President read the "Report on the Excavation of the Earthwork known as Ambresbury Banks, Epping Forest," which had been drawn up by General Pitt-Rivers, F.R.S. [Transactions, ii. 55.]

The plans and sections of the camp (enlarged for the occasion by Mr. H. A. Cole), and photographs of the works by Mr. J. Spiller were exhibited, as was also the coloured plate of some of the objects found, which the author proposed to publish in the 'Transactions' at his own expense.

The Rev. W. Linton Wilson, as a member of the Committee of Exploration, proposed that a very hearty vote of thanks should be passed to General Pitt-Rivers for the excellent report he had prepared and for his liberal donation of the coloured plate to illustrate the same. The plate would cost about £12, and was therefore a very handsome present to the Club.

Mr. Henry Walker warmly seconded the proposal. They had very successfully arrived at the conclusion that the Camp was British,—either ante-Roman or post-Roman,—but after all it occurred to him they had not invalidated the tradition that the work was associated with the British Queen Bodug, whom all had read of under the Latinised name of Boadicea.

The vote of thanks was passed by acclamation.

The President hoped that the Club would not allow the work so well begun to drop. The county of Essex appeared to be particularly rich in these early earthworks. He considered that they could investigate these without in any way trenching upon the province of their colleagues the Essex Archæological Society, inasmuch as in them they were

mainly dealing with pre-historic periods. He hoped that at least next year they might be enabled to commence a similar excavation at the Loughton Camp, and a subscription would be started for that purpose at once. The camp they had visited that afternoon on Danbury Hill should also be well kept in mind—no one appeared to know anything about it, and he was afraid many local gentlemen were somewhat sceptical as to the existence of a camp there at all. That also should be a matter for future investigation, and he confessed that he would very much like to see the Club with its shovels and picks at work on those ramparts. [Laughter and applause.]

Mr. Chancellor said that the late Lord Braybrooke, who took great interest in earthworks, visited the mounds at Woodham. He (Mr. Chancellor) spent the whole day with him there, and his Lordship came to the conclusion that these mounds were erected merely for the protection of cattle in flood time. He hoped the Club might be enabled to investigate one of these mounds. At Ashington, where a great battle was fought, there was a mound and evident traces of earthworks of some age. Mr. Chancellor also referred to the Roman camp at Bradwell, which was investigated by the Archaeological Society, and which was proved to have been a walled camp, with circular towers at the angles.

The President asked if any excavation had been made at Danbury.

Mr. Corder said that he had lately heard of some so-called Roman remains having been found there.

Prof. Boulger remarked, that in almost every place he had visited, the name of which ended in "bury," he had recognised earthworks.

Mr. Fitch mentioned the Barrow Hills, between Heybridge and Goldhanger. It was there that the great battle of Maldon was fought, the bloodiest battle before the Conquest. Some thirty or forty years ago they were diminished and a number of bones were then found.

Mr. Chancellor, at the close of the meeting, proposed a vote of thanks to Mr. Meldola, which was seconded by the Rev. C. B. Hamilton, and carried unanimously.

During the meeting Mr. Fitch exhibited a fine living larva of the Death's Head Moth (*Acherontia atropos*) found near Maldon feeding upon the Bitter-sweet (*Solanum dulcamara*).

--- --
SATURDAY, SEPTEMBER 24TH, 1881.—ORDINARY MEETING.

The Nineteenth Ordinary Meeting of the Club was held at the Headquarters, Buckhurst Hill, at seven o'clock, the President in the chair.

Donations of books, pamphlets or periodicals (exclusive of exchanges) were announced from Messrs. H. J. Barnes, Walter Crouch, H. G. Fordham, A. Lockyer, R. Meldola, and Miss E. A. Ormerod. A unanimous vote of thanks to the donors was passed.

The following were elected members of the Club:—James W. Cook,

Bernard T. Halford, B.Sc., Charles J. Leaf, F.L.S., F.G.S., F.R.M.S., F. H. Meggy, Mrs. Marshall, F. G. Newman, Frederick Oliphant, George Rees, Simeon Warburg, and Compton Warner.

Mr. Lockyer announced that Mr. Fletcher, President of the Ottawa Naturalists' Field Club, would be happy to send specimens of Canadian plants to any member wishing to study them.

The Secretary called attention to the work which is being done by the Essex Bee-keepers' Association, and distributed some copies of the prospectus and rules of that Society.

Mr. B. G. Cole exhibited a specimen of *Abraxas Ulmata*, taken by himself in Bury Wood, Epping Forest, last July. He had not previously heard of the occurrence of the moth in the Forest. Mr. Cansdale informed him that the species had been taken at St. Osyth, Essex. He also exhibited a remarkably small specimen of *Liparis auriflua* (the Gold-tailed Moth), taken at large near Loughton, in July last. This dwarf was less than half the normal size of the species.

Mr. H. A. Cole exhibited and presented to the Museum two worked flints which he had recently found. The most perfect one was from Great Parndon, Essex. Near that village he had come upon a heap of stones which had been picked off the neighbouring fields. This heap contained a considerable number of ordinary glacial fossils, *Gryphea*, *Echinus*, lumps of lime-stone, &c., with chalk-flints and fragments of rock of various kinds. On carefully searching the heap he had found a flint bearing evident marks of human workmanship. Judging from its form it had probably been hafted to a handle and used as an adze in agricultural operations. The specimen had been shown to Dr. Evans and General Pitt-Rivers. The second flint Mr. Cole had picked up in the Epping New Road, near High Beach, from a heap of gravel by the roadside, which had probably been dug from the Forest pits close by. The celt was a very rude one, and was quite white upon its surface, an appearance probably due to aqueous action, the soluble particles having been removed by the infiltration of water through the body of the flint, while the insoluble portions had been left in a finely divided state, and consequently reflected white light.

The President said that those disposed to hunt for these interesting relics of a time long past might take a hint from these finds of Mr. Cole. The last remnants of the "Stone Age" were to be found scattered over the surface of the country in ploughed fields, &c., and as stones were often gathered by farmers from the fields, it might be profitable to submit the spoil-heaps to a rigorous examination when found in suitable localities.

Mr. W. Cole showed several species of Coleoptera, including the scarce Rose-beetle, *Gnorimus nobilis*, which he had found on bramble blossom in Lodge Bushes, Epping Forest, in July last. He also exhibited some specimens of Essex insects, Hymenoptera, Diptera, Coleoptera, &c., sent by Mr. Billups to illustrate the modern methods of preparing insects for

the cabinet. Also a box containing "life-histories" of several species of moths, showing caterpillar, chrysalis, cocoon, imago, parasites, &c., in one view, which he had prepared as a kind of ensample of the biological collections he would like to see in the Club's Museum.

Mr. Crouch said that he was much interested in Mr. Cole's specimens, inasmuch as they illustrated a principle he had long maintained as the right one to be followed in a collection intended to be of educational value, viz., the demonstration of the structure of an animal in all its stages, and not merely of one phase of its development. He had endeavoured to carry out the plan in his own special study, conchology, which was too often looked upon as a kind of artificial classification of an important group of animals by means of one very superficial feature in their organisation, the shell or protective envelope of the body. He hoped soon to be able to submit to the Club some specimens which would illustrate in a measure his views on the subject.

A paper "On the Land and Fresh-water Mollusca of the district around Colchester," by Mr. Henry Laver, F.L.S., was read by the Secretary. [Transactions, ii. 88.]

The President observed that Mr. Laver's paper appeared to be of considerable value as embodying the result of close personal observation in a limited area, and as giving so much precise information as to the environment of each species. He took it that the paper was typical of the kind of communications they desired to have in the 'Transactions' of the Society, and he had only one suggestion to make, viz., that authors could add much to the interest and value of their communications by exhibiting the specimens described, and, if possible, placing an authenticated series in the Museum of the Club, so as to be available for future reference.

Mr. Walter Crouch said he had listened to Mr. Laver's paper with much pleasure, and could but echo the wish of the President that the author had sent specimens of the various shells. It was curious to note that some of the genera and species which were very common in the Becontree Hundred had not, so far, been found by Mr. Laver in his district. Mr. Crouch instanced the genus *Vertigo*, species of which are extremely difficult to find on account of their minute size, and of which he had obtained some thirty specimens that season, embracing certainly three or four of the species; and *Physa hypnorum*, which, though rare with the author, was one of the commonest shells in the meadow grips in his own district. He had seen this shell and that of *Limnæa peregra* in scores, left high and dry after a flood in the Roding Valley. On the other hand, the pretty little land snails, *Helix aculeata* and *Achatina acicula* he had never had the good fortune to find; and though the river snail, *Paludina vivipara*, was extremely common in the Roding, it was not mentioned by Mr. Laver, while the other species, *P. contecta*, which Mr. Crouch had never found in Essex, was stated to be found in the Stour, and of very large size. *Balia perversa* was rare in both

districts, and he had only found two specimens. For the genus *Clausilia* he had been searching, and felt sure it existed in the district, as he once found after a flood one broken shell of *C. rugosa* (?) washed down into the river at Barking Side, but he had not met with a perfect shell. He might also add that, without opening up the old and vexed question whether *Helix nemoralis* and *H. hortensis* were distinct species, he had found with Mr. Laver that where one was common the other was not. He had examined that year some 500 or 600 specimens of the former at Barking Side and found not a single white-lip, while at Leytonstone and other places he could always find *hortensis* and never a brown-lip.

A paper by Professor Boulger "On the River-basins of Essex as Natural-history provinces," being an appendix to his paper read at the Chelmsford Meeting, was read [Transactions, ii. 79.] The paper was accompanied by a sketch map of the county, showing proposed natural-history provinces, and the author requested the kind assistance of residents and others in determining the nomenclature of various small streams which were unnamed in any maps to which he had access.

Various observations respecting the maps of the county and other sources of information were made by Messrs. Fisher Unwin and Crouch, and cordial votes of thanks were passed to Mr. Laver and Prof. Boulger for their papers.

The President referred to the Conference of Local Scientific Societies held at the York Meeting of the British Association, which he had attended as delegate on behalf of the Club. Suggestions had been made as to work which could be carried on by local societies, but speaking on behalf of their own Club he thought that the line of action they had adopted would give the society plenty of good opportunities for work during the next few years.

At the Conversazione, Mr. Oxley, F.R.M.S., exhibited a fine series of doubly-stained sections of various vegetable stems under the microscope; Mr. English a long series of fresh specimens of Fungi, named and arranged with great care, including a specimen of the rare *Helvella lacunosa* from Epping Forest; Mr. W. Crouch a long series of "varieties" or aberrations of *Helix aspersa* and *nemoralis*; and Mr. Oldham some specimens of sand strata from Ipswich.

SATURDAY, OCTOBER 1ST, 1881.—ANNUAL CRYPTOGRAMIC MEETING, AND
ORDINARY MEETING.

[Mr. Worthington Smith has kindly allowed us to use the humorous report of our Meeting, written by him for the 'Gardeners' Chronicle' of October 8th, 1881. A few necessary additions and alterations have been inserted, but in the main the report is in Mr. Smith's own words. The list of Mosses, Hepaticæ, and Lichens, is given on the authority of Mr. E. M. Holmes, F.L.S.—ED.]

To Mr. Malcolm McLean, Gardener to J. Whatman, Esq., Vinters Park, Maidstone, belongs the honour of sending the champion fungus of the year for exhibition at our Annual Fungus Meeting. His name and address should be preserved in the archives of fungology for ever. A letter preceded the fungus stating that it was very big, that it had grown at the base of a Scotch Fir, and had only once before been seen in Vinters Park. The request to send the fungus up was at once complied with, and it came in an enormous deal box (now a spacious and luxurious rabbit-hutch) painfully carried by two men. On opening the box a delectable fragrance poured out, and on removing the shavings a stupendous specimen of the rare and edible *Sparassis crispa* was seen—such a specimen as had probably never before gladdened the eyes of any fungologist. A common size for *Sparassis* is that of an orange, or possibly a small round melon, but here was an example of massive and cyclopean proportions—three feet six inches round, ten inches high, and with a solid rooting base six inches deep. As far as the writer knows, such another specimen has never been seen or even dreamed of “in tale or history.” It was no easy matter to get this fungus to Loughton, but after all the rooting portion had been cut away it was divided into two pieces, and dropped into a couple of large open fish-baskets. These baskets the writer took by hand to Liverpool Street, very much in the style of an itinerant street vendor of sponges, with a very large stock-in-trade. The first person met at the station was Dr. Spurrell, who, with quick geologic eye, took the cream-coloured, sponge-like masses for a series of magnificent examples of teeth of *Elephas primigenius*, which indeed they very much resembled; but the ambrosial fragrance, so different from that pertaining to elephant's teeth, soon advised him of the true nature of the treasure. Two fungologists carried the fish-baskets to the “Crown” Hotel, and lovingly placed the *Sparassis* in the room set apart for the exhibition of the day.

This second “Fungus Foray” of our Club, in welcome contrast to the first, was held under very favourable meteorological conditions: the day was such as one would have chosen—warm, bright, and delightful. Seen in the brilliant sunshine, the woods of Epping Forest presented some charming features of colour and form, and the special objects of our search were abundant, although a few species were perhaps a little *passé*, the fungus season, at least in the Forest, having opened somewhat earlier than usual. The band of experts invited by the Secretary to act as leaders and advisers was remarkably comprehensive. Dr. M. C. Cooke was one of the first fungographers to arrive at Loughton, accompanied by Dr. H. T. Wharton; soon after Dr. Braithwaite was on the spot, with Mr. W. W. Reeves, Dr. Spurrell, Mr. Worthington Smith, Mr. A. Heath, Mr. J. A. Johnson, and many other professional or amateur botanists. Seventy members and friends had sent in their names as desiring to be present, but more than a hundred persons actually attended. Mr. English's local knowledge was very useful, and Mr. E. M. Holmes being

also with the party, Cryptogamic Botany in all its branches was well represented.

The section of the Forest searched included the district of High Beach, Great and Little Monk Woods, and the Woods near Theydon Bois. The gatherings were very large, and in the presence of such a band of accomplished botanists very few species went unnamed. The ladies of the party set out their spoils in open baskets with moss and fern, thereby revealing the wealth of colour and beauty that is to be found in the commonly despised mushrooms. Many of the baskets would vie in appearance with the finest bouquets, and they afforded hints for the decoration of rooms at seasons when flowers are not abundant, for an hour's gathering would furnish a collection of brilliantly coloured forms with which an artist might be enraptured.

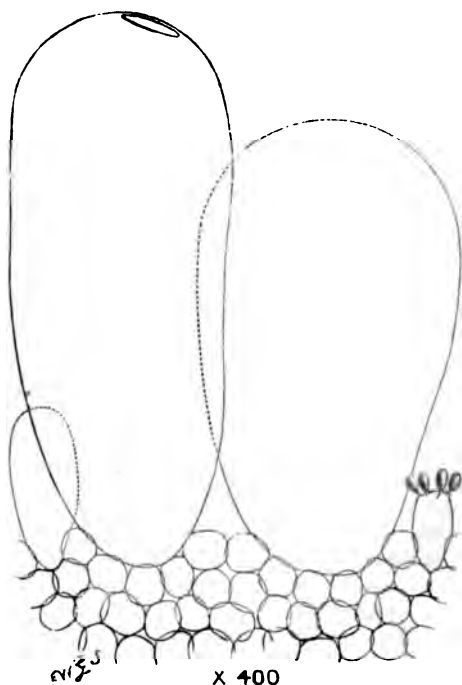
Hygrophorus eburneus was very abundant, a white and sticky species, said to be edible; a close ally and "consort" of this plant was also frequent in *H. cossus*: the latter is much more glutinous, its top is slimy, and the whole plant is rich in the potent odour of the he-goat, or—to those who are not fortunate enough to know this odour—the scent of the larva of the Goat Moth (*Cossus ligniperda*). The viscid tops of the specimens of *H. cossus* were covered with dead flies, at first probably attracted by the odour and then caught and suffocated by the gluten. Some of the younger members claimed these Fungi as undoubtedly "carnivorous plants"; they carefully placed them in their baskets, determined (they said) to look for and find pepsine, distended fungus-cells, and digestive cavities! Another handsome ally is *H. chrysodon*: this was once or twice met with; the plant is named "*chrysodon*" from its fancied resemblance in colour to the beautiful golden-greenish stone named "*chrysolite*." One gentleman found a vegetable beef-steak, *Fistulina hepatica*; and another botanist, who had gathered one the day before, brought it to the Forest cut up in slices between bread in the form of sandwiches. This was an inveterate fungus-eater, for he even dispensed with mustard, and secured the necessary pungency by the insertion of thin slices of the fiery *Lactarius piperatus*. We cannot all go to such lengths! One or two specimens of the gorgeous vermilion-coloured *Cortinarius cinnabarinus* were found with many examples of its handsome, but more soberly tinted ally, *C. cinnamomeus*. *Agaricus rubescens* was very frequent; this plant is commonly said to be edible, although Mr. Berkeley cautiously omits any reference to its esculent qualities. Dr. Wharton stated that this plant is not only good for food, but is excellent for its production of a refined and appetising ketchup, not so rich as that peculiar to the mushroom, but a delicate nepenthe, fit for the gods. The beautiful "consort" of *Agaricus rubescens* was present in *A. pantherinus*, perhaps as edible as the last, but seldom or never changing to sienna-red when broken or bruised. The golden-yellow edible Chantarelle, *Cantharellus cibarius*, was frequent; so also was its duller-coloured but more elegant ally, *C. tubaeformis*. *Russulas*, so called because many of the species are red in colour, were

extremely abundant and very difficult to determine; some are very tender, some very tough; some fleshy, others almost woody; some with an inseparable cuticle, others with a separable one; some white and some red under the cuticle; some mild and innocent, some so intolerably pungent that if placed on the tongue, the skin of that delicate organ will speedily peel off with a blister, and (like *Russula emetica*) show red underneath! The lovely but untouchably glutinous *Agaricus mucidus*, generally so frequent on the High Beach beeches, was this year nowhere to be seen. The Falstaffean *Boletus edulis* was common, as well as *B. chrysenteron* and *B. subtomentosus*. The milk mushrooms, *Lactarii*, were abundant; the poisonous, livid, *Lactarius lividus*, was everywhere; *L. quietus*, so mild that none need fear his quietus from consuming it, was also very common; "odour oily—like bugs," writes Mr. Berkeley; other authorities say the odour is "mealy, like recent farina." Perhaps the "mealy-bug" was in view, but this is not stated! *Boletus scaber*, grey, ugly, sticky, and vile to the sight, albeit an edible species, was to be noted almost everywhere; and *B. luridus* was frequent, rapidly changing to blue when cut or broken—a pretty toy for the ladies, quickly poisonous to some people, but a delicious viand to the indurated hippogastrous fungo-phagist. We must not, however, weary our readers by attempting a catalogue of all the species met with; a list of the forest Hymenomycetes as far as at present ascertained, is given in this part of the 'Transactions'; most of them are common in the woods every autumn, and many were recorded in the account of last year's fungological ramble [Proceedings, i. xlviii.]

Many of the visitors were struck with the beauty and luxuriance of the golden *Peziza aurantia*, growing in large patches in and about the road ruts and newly-cut water-courses, particularly in Fairmead Bottom and near Golding's Hill.

But one remarkable fungus certainly demands a special paragraph in our records, viz., *Coprinus aratus*. This is probably a rarity, and has not been seen by the writer for the last twenty years. Mr. Berkeley first found it "in a hollow tree." It was one of the first Fungi to attract our notice when commencing the observation of the Cryptogamia, growing twenty years ago at the bottom of a dung-heap in Nottinghamshire. *Coprinus aratus* is one of the larger, deliquescent, fugitive species; it grows to be six inches high, stem tapering upwards, very hollow and fragile, a top from three to five inches across, tender, and breaking to pieces with a touch. It lives less than a day, and in decay it curls up into beautiful volutes, and distils itself away into drops of black and tumid ink. Dr. Wharton had the pleasure of discovering the specimen in Monk Wood, which was, alas! but a ruin, suffering from a dread and fatal mycocyam; however, the remnants were brought carefully home for the microscopic examination of the *cystidia*. As these organs (concerning the exact nature of which much difference of opinion prevails, although Dr. Cooke states that the evidence seems to be in favour of the

view that cystidia are barren conditions of the ordinary spore-bearing structures or basidia) are more developed in *C. aratus* than in any other species yet examined, an illustration is here given, for the loan of which we are indebted to the courtesy of the Editor of the 'Gardeners' Chronicle.' The ordinary cells of the plant are seen at the base of the figure—a basidium with its four spores on the right, and two of the gigantic cells, termed cystidia, occupy the body of the illustration. It is a curious fact that all the cystidia in the specimen examined grew on the gills close to the insertion of the stem, and none were to be found towards the edge of the cap; they may have dropped to the ground from this part of the plant with the falling spores.



Cystidia of *Coprinus aratus*.

The other classes of Cryptogamia were attended to by Dr. Braithwaite and Mr. E. M. Holmes. We have no report from the former gentleman, but Mr. E. M. Holmes has furnished the Secretary with the following lists of Lichens, Mosses and Scale-Mosses met with during the day, and has kindly deposited the specimens on which the lists are founded in the Club's Museum for future reference. The area of collecting was in the

neighbourhood of the "Green Ride," from Staples Hill to Monk Wood, and more particularly in the latter place.

LICHENES (named in accordance with Rev. W. A. Leighton's 'Lichen Flora of Great Britain,' 2nd Edition):—

<i>Calicium hyperellum.</i> On old trunks, Monk Wood.	<i>Parmelia physodes.</i>
<i>Cladina rangiferina.</i>	<i>P. saxatilis.</i> Monk Wood.
<i>Cladonia pyxidata.</i>	<i>Pertusaria communis.</i> Monk Wood.
<i>Evernia prunastri.</i>	<i>Lecidea (Griffithii) tricolor.</i> Monk Wood.
<i>Parmelia olivacea.</i>	

HEPATICÆ (named in accordance with Dr. Cooke's 'British Hepaticæ'):—

<i>Jungermannia albicans.</i>	<i>Fossombronia pusilla.</i> On the banks of the stream crossing the Green Ride near Debden Slade.
<i>J. ventricosa.</i>	
<i>Lophocolea bidentata.</i>	
<i>L. heterophylla.</i> Monk Wood.	

MUSCI (named in accordance with the 'London Catalogue of British Mosses,' 2nd Edition, 1881):—

<i>Weissia cirrhata.</i>	<i>Mnium hornum.</i>
<i>Dicranella heteromalla.</i> Monk Wood.	<i>Tetraphis pellucida.</i>
<i>Dicranum majus.</i>	<i>Polytrichum formosum.</i> Monk Wood, &c.
<i>D. palustre.</i>	<i>Neckera complanata.</i> Growing with <i>Hypnum cupressiforme.</i>
<i>Campylopus flexuosus.</i> Monk Wood, in fruit.	<i>Thuidium tamariscinum.</i>
<i>C. pyramidalis.</i>	<i>Eurhynchium myosuroides.</i>
<i>Leucobryum glaucum.</i> Monk Wood.	<i>Plagiothecium undulatum.</i> Monk Wood.
<i>Pleuroidium nitidum.</i> On banks of stream crossing Green Ride, near Debden Slade; also in Monk Wood.	<i>Hypnum cupressiforme.</i>
	<i>H. purum.</i>
	<i>Hylocomium splendens.</i>

Owing to the attractions of the Fungi the Phanerogamia were but little noticed, the only plant gathered worth recording being *Gnaphalium sylvaticum*, which was growing plentifully in the open gravelly ground near Monk Wood. Mr. Saville Kent was with us, ready to afford information to the student of minute life in the searching of ponds and ditches, but no report of captures has reached us. Mr. Kent found some forms of the dubious *Myxomycetes*, concerning the fungoid or infusorial nature of which so much discussion has recently taken place.

As dusk began to fall the large party made towards the "Crown" Hotel, Loughton; everyone being furnished with ample stores of specimens. Arrived at the Inn, the bags and boxes were carefully emptied and the Fungi ranged in due order in the room set apart for the exhibition, and then came the usual Club tea.

After tea the 20th Ordinary Meeting of the Club was held, the President in the Chair.

The following were elected members :—Messrs. Garrad Baker, Frederic Chancellor, F. R. Harold, F.S.S., F. H. Hempleman, F. J. V. James, Charles A. Onley Marsham, J.P., G. H. Raynor, M.A., and W. H. Stead.

On the motion of the President a cordial vote of thanks was passed to the distinguished botanists who had so kindly acted as leaders and advisers during the day.

On the circular calling the Meeting, a short address, to be entitled "Half-an-hour with the Fungi of the Loughton District," had been set down to Dr. Cooke. He said, however, that when he promised to give that address it was before a sad calamity fell upon him, which had prevented him for some months from paying any attention to affairs in which the mind or hand had to be engaged. Under other circumstances he should have been extremely happy to have carried out his promise, and to have read a paper. But as that was the first time for two or three months on which he had attempted to address an audience, they would accept that as an apology for not carrying out to the full extent the promise he gave. He had intended to give a *résumé* of such Fungi as he knew to be, or such as had been recorded to have been found around Loughton, or in Epping Forest. He had thought that such a list, if rendered complete, as it could be, would be a very useful one to be included in their 'Transactions,' since no list, so far as he knew, of the Fungi of Essex, had ever been collated or published. Dr. Cooke then referred to several Fungi noted by Sowerby as found in the Forest, and called attention to a paper contributed by Mr. English to the 'Transactions' of the Essex Field Club. He intended to write out a list of the Forest species, and submit it to an early meeting of the Society. After referring particularly to several of the more remarkable species, Dr. Cooke went on to urge that the Forest should be systematically scoured; if everybody in that room were to set about the work for twelve months what a number of new species they would have, or if not new species, yet species that were only hitherto known as occurring upon the Continent. Do not let them think that there were fewer Fungi in Epping Forest than in Herefordshire, or in any other part of England. He believed there were as many, and that as long a list could be made out, and he doubted not that at least two-thirds of English species—and more—could be found in the Essex Woodlands. [Applause]. In mentioning the species peculiar to the Forest, Dr. Cooke inadvertently omitted the lovely, but sticky, little *Agaricus Worthingtonii*, so named by Elias Fries, in honour of the writer of this record, and of Epping Forest. *A. Worthingtonii* is peculiar at present to the Forest, and long may it remain so: the original Friesian MS. description is in possession of the Club.

Mr. Worthington Smith followed with some remarks upon special Forest species, and some elementary hints as to the modes to be adopted in identifying Fungi; then Dr. Braithwaite spoke of the mosses of Epping Forest, and of mosses in general, and how to find and study them. Mr. E. M. Holmes had brought with him some excellent diagrams illustrating

most of the largest families of British Mosses, as well as some type specimens, which were on exhibition, and which are now deposited in the Museum of the Club. He also exhibited specimens demonstrating the principal groups of British Lichens, and explained the leading characteristics of each. He expressed himself as being somewhat disappointed with the lichens he had met with in that day's excursion, and believed that those who wished to explore the Lichen Flora of the county must go farther afield. A number of rare lichens had been found by Mr. E. G. Varenne, in the neighbourhood of Kelvedon, and he felt sure that a very good list might be made out if Essex were systematically searched. So far as his experience went it was of little use to look for lichens within twenty miles of London. The immense volumes of smoke sent up by the great city seemed to influence the atmosphere (probably being carried by the prevailing winds) to that distance. The existence of lichens in a healthy state on trees indicated a pure moist air. Lichens also liked wind and light, consequently the trees on the outskirts of woods were generally better clothed with them than those in the interior. These facts seemed to militate against the Algal-Fungus (or Schwendenerian) theory of lichens; since Fungi as a rule shun the light, and moreover they are with few exceptions ephemeral plants, while lichens are of very slow growth and endure for many years. Fungi might be noticed in abundance in the immediate neighbourhood of London, but lichens could not be found in a perfect or healthy condition within many miles of that city. It was true that *Lecanora galactina* might be found on Kew Bridge or on walls in the Caledonian Road; but it speedily disappeared and became replaced by mosses. It was a remarkable fact that hardly any lichenologists believed in the Schwendenerian hypothesis, although it was accepted by several vegetable physiologists of high repute. It was very instructive to observe the stages in the growth of lichens in the course of a walk from London towards the country. First the gonidial (or algal?) state was met with on trees, and then evidently the same plant showed an imperfect thallus, and at last the perfect thallus and the fructification were met with at a sufficient distance from town. If the lichen be a compound of fungus and alga, it is the alga that appears nearest to London, and not, as might be supposed, the fungus. Mr. Holmes had observed this development in the case of *Lecidea canescens* in the course of a walk from Chislehurst to Chelsfield. But although the list of lichens in Epping Forest was certain to be a meagre one, the Moss Flora would probably well repay examination, judging from the specimens met with during the day.

The party then adjourned to the exhibition room, where an hour or so was agreeably and instructively spent in examining and determining the large number of Fungi there displayed. Part of the gigantic *Sparassis* had mysteriously disappeared (*vide* 'Gardeners' Chronicle'), but enough remained to allow many mycologists to carry off slices as mementos of our Fungus Foray of 1881.

SATURDAY, OCTOBER 29TH, 1881.—ORDINARY MEETING.

The 21st Ordinary Meeting was held at the Head-quarters at seven o'clock, the President in the Chair.

Donations of books or pamphlets were announced from Messrs. E. Brown, S. N. Carvalho, B. G. Cole, R. Meldola, and Miss M. S. Ridley. Various specimens for the Museum were contributed by Messrs. English, Travis, White, and E. M. Holmes, F.L.S. A unanimous vote of thanks to the donors was passed.

The following persons were balloted for and elected members of the Club:—Lord Eustace Cecil, M.P., Sir H. J. Selwin-Ibbetson, Bart., M.P., Miss Marian Ridley, and Edward Unwin.

The President announced that at the York Meeting of the British Association, the Report on the Excavations at Ambresbury Banks had been read, and that subsequently the Secretary had received the following communication from Prof. Bonney:—

“British Association for the Advancement of Science,
“22, Albemarle Street, W.,
“13th October, 1881.

“Sir,

“I am directed by the General Committee of the British Association for the Advancement of Science, to transmit to you the following Copy of a Resolution, which was adopted by the Committee at the last Meeting of the Association, and to request your attention thereto:—

“That Mr. R. Meldola, General Pitt-Rivers, and Mr. Wm. Cole, be a Committee, for the purpose of investigating the ancient earthwork in Epping Forest, known as Loughton Camp; and that Mr. W. Cole be the Secretary.

“I have the honour to be,

“Your very obedient Servant,

“T. G. BONNEY, *Secretary.*

“To W. Cole, Esq.”

He thought that the Club might be congratulated on receiving this recognition of its work at the hands of such an influential body as the British Association, and he hoped it would prove an incentive to the members to support the Society in the course of action it had struck out for itself.

Three communications stood for discussion upon the Agenda paper: Mr. Fitch asked permission to take his essay first as he had to return to Maldon that evening. The paper, entitled “The Galls of Essex,” [Transactions, ii. 98], was then read by the author. Mr. Fitch illustrated his memoir during its delivery by the exhibition of various coloured plates contained in Dr. Adler's essay and other German publications, and by references to his own extensive collection of galls and gall-making insects, with their inquilines and parasites, which he had brought with him, and which was on view in one of the meeting rooms.

The President, at the conclusion of the paper, said he was sure all the members of the Club would agree with him that they were much indebted to their Vice-President for his admirable treatment of a subject which presented so many points of interest to them all, and one which Mr. Fitch had for many years made a special study. In addition to the important list of the galls of their county, the author had given a most valuable introduction containing a *résumé* of the different theories of the cause of galls which had been propounded; and he (the President) felt sure that a subject which appealed to so many different classes of their members—to their zoologists, botanists, and general biologists—would be warmly taken up. The President thought that the best compliment they could pay to Mr. Fitch would be to discuss the subject thoroughly; and in inviting observations upon it he felt confident that the author would be only too glad to reply to any questions that might be put to him.

A long discussion then took place with reference to various points in the history of galls touched upon in the paper.

Dr. Pearce took exception to Sir James Paget's opinion that there was an analogy between the growth of galls on plants and the morbid processes exhibited in many diseases of the human subject, but before considering that point, he wished, as a new member of the Club, to express the pleasure with which he had listened to Mr. Fitch's paper; he had never heard a more complete bringing together of a multitude of facts and observations than that which the essayist had presented to them that night. Returning to the allusion in the paper to the inoculation of the human system with the several "viruses"—such as variola, vaccina, cancer, syphilis, and other inoculable and constitutional diseases—he understood the essayist to state that the formation of galls in the vegetable kingdom bore a resemblance to the action of the said viruses in the animal system. In his (Dr. Pearce's) opinion a distinct line must be drawn between the two classes of phenomena; and while there was some dispute amongst biologists as to whether galls were due to the mechanical irritation of the egg, or to the introduction with it of some stimulating fluid by the insect which tended to produce the galls, there was still no real analogy between their production and the results following an inoculation with animal virus. On a tree the egg of a gall insect might be immediately productive of a morbid growth—a gall limited to a given spot, and not affecting the life or disturbing the general condition of the plant. In the case of inoculating, whether with variola (small-pox) or vaccina (cow-pox), a process of fermentation is set up, permeating and affecting the whole system—giving evidence of its existence after the lapse of a certain fixed number of days, by the appearance in vaccina of a vesicle at the seat of inoculation, or, as in the case of variola, developing on every part of the surface of the body hundreds of vesicles, which ultimately become pustules. He further remarked that there did not reasonably appear to be a resemblance between galls in the vegetable kingdom and certain skin diseases incident to the *genus homo*, children more

especially. These he thought partook of a vegetative or fungoid, parasitical nature, and were clearly distinct in their origin and development from true galls produced by insects.

Mr. Letchford called attention to the very remarkable chemical substances found in abundance in the tissues of many galls. These substances appeared to exist in the sap of the trees, but became concentrated in the galls, and seemed to be a necessary concomitant of their growth.

Mr. Henry Walker gave some details as to the morphological structure of galls, and alluded to the appearance of the Devonshire or "Marble-gall" (*Cynips Kollari*), near London, within living memory. Many years ago the late Frederick Smith put a large quantity of these galls into Highgate Wood, and he thought it was possible that the rapid spread of the marble-gall might have had some connection with that circumstance. Mr. Walker also called attention to the bearing of the very remarkable observations of Dr. Adler as to the existence of di-morphism in galls upon the current theories of evolution.

Mr. Meldola stated that there had always appeared to him one difficulty in connection with the mechanical theory of galls which he would be glad to see explained. He did not wish his remarks to be considered in any way critical, but he could not help feeling that there was an objection which Mr. Fitch would perhaps throw some light upon. In accordance with what he would call the purely mechanical theory of galls these growths were caused by the presence of the egg of the insect laid in the leaf-tissue or other part of the plant, and acting as a local irritant. He could easily understand how on this view differently formed galls might result from the irritating action of eggs laid in different parts of the plant, but he could not see how on this theory it was possible to account for the fact that on the leaves of the same plant a large number of insects could each give rise to a differently formed gall. It had been proved that the egg continued to grow for some time within the gall, but this did not appear to him sufficient to explain the fact mentioned. A different form of egg, and a different rate of growth for each species, was assumed, but this was so far only an assumption; experimental and observational proofs were required in order to demonstrate conclusively that there existed a connection between the form and rate of growth of the egg and the form of the gall. As to the points raised by Mr. Walker, Mr. Meldola said that he had lately been working at them, and hoped to address some remarks upon the subject to the Club at the Annual Meeting.

In reply, Mr. Fitch stated, with reference to Dr. Pearce's remarks, that Sir James Paget, in making his comparisons, had expressly noted the great contrasts between the pathology of animals and plants. From his own point of view also it was by no means intended to institute a comparison between the special viruses which we know are capable of being artificially introduced into the human body, or with

our own specific diseases. We must remember that the sap-flow in plants is by no means analogous to the circulation of the blood in animals, and there is an absence of the complex nervous system. A nearer analogy might be traced in the known specific action of various blisters and irritants, or in the production of local abscesses, festers, or like simple humours, from the inflammation set up by the irritating presence of some foreign substance. Mr. Fitch said that although a firm believer in the mechanical oval and larval irritation theory, he thought it probable that the application or removal of pressure, the stimulated growth to throw off the foreign substance introduced, and other secondary causes, also came into play. He had referred to the production of warts, and to make a rough comparison he would instance a hairy wart in which we found an excessive development of cuticle and an increased development of the vascular secretory structure, with the exudation of an abundant quantity of fluid, causing the extra growth of hairs; compare this with the familiar "Robin's pin-cushion," or Bedeguar gall of the rose, where we had excessive development and thickening of cambium tissue and bark with an increased afflux of nutritive matter, resulting in the enormously developed growth of leaves, remembering that the so-called "hairs" with which the gall is covered are really leaves abnormally developed, with scarcely any parenchyma between their fibro-vascular bundles. Dr. Pearce must also remember that we are not yet by any means fully acquainted with the relationship between the formative stimulus (mechanical or otherwise) and the supporter of the stimulus; this also answered, or rather failed to answer, our President's question as to why the galls, quite constant in themselves, which occur in exactly similar situations should exhibit such varied forms. Our present knowledge was not able to give a ready solution to this involved problem, but we know that there are still many well-known but ill-explained facts in both animal and vegetable pathology. Mr. Fitch expressed a hope that some of the structural botanists in the Club would turn their attention to these important and interesting points.

The analogy between the various skin diseases in the human subject attributable to fungoid presence, and the numerous varied and well-marked fungoid vegetable galls, alluded to by Dr. Pearce, stood on a similar footing, but with a more perfect concatenation. The subject of the useful chemical properties, remarked upon by Mr. Letchford, was of true commercial importance, and deserved more attention in this country than it at present received. The tannic and gallic acids were undoubtedly more concentrated in the substance of certain oak-galls than in the oak bark itself; but why we should annually import from £70,000 to £80,000 worth of galls for tanning purposes, while our own large crop of oak marble-galls is unmarketable except for the manufacture of rustic baskets and similar trinkets, requires further explanation. Chemical analysis hardly warrants this neglect of our native galls. Mr. Fitch

added that the question put by Mr. Walker, as to whether in the Cynipidae alluded to we had a case of evolution *per saltum*, opened a very wide field for discussion, and one which had better perhaps be deferred or left in the able hands of the President. He would however observe that the dimorphic theory really only implied travelling on a double line of rails instead of a single one. The dimorphic forms were both constant in themselves; but the tendency to variation, the break of unity in habits, and the production of a temporary new form, were remarkable facts, and well deserved every attention from the biologist.

At the close of the discussion a hearty vote of thanks was accorded to Mr. Fitch for his valuable paper.

Sir T. Fowell Buxton, Bart., communicated the following :—

“NOTES ON THE OCCURRENCE OF A HONEY BUZZARD (*Pernis apivorus*) IN
EPPING FOREST.

“I think it worth while to mention and record that I yesterday and again this morning (Saturday, September 24th, 1881), saw a Honey-Buzzard in the Forest. It rose from a bush of beech close to my feet, and flew with rather a heavy flight to an oak about twenty yards off, where it remained for a few seconds. On examining the bush I found it swarming with wasps, which began to fly out on my touching the bushes. I then found pieces of wasps' comb lying on the ground outside the bush, and the dead leaves scattered around.

“This morning (September 24th), on approaching the spot, we again saw the bird flying over the trees away from us. Much more of the wasps' comb was lying about, and a large cavity could be seen under the branches where the nest had evidently been scratched up, and the contents strewn around. The branches of the bush showed no signs of injury, as they would have done had any man disturbed the nest. The account of the bird in Gould's ‘British Birds,’ leaves no doubt that the name is correctly given. The spot was about thirty yards from and above the spring, E.S.E., on the Woodredon Hill.

“The bird was again seen, by Mr. Andrew Johnston and myself, on September 25th during the afternoon, as it was rising from the same wasps' nest as before. It was thus seen on three days consecutively. I hope the place will not become so well known as to risk its being trapped.

“On visiting the spot on the 28th the Buzzard seemed to have left the place, but the remains of the wasps' nest were clearly visible at the side of the hole, grubbed up by the Buzzard as I suppose.”

Under date October 19th, Sir Fowell Buxton adds :—

“On coming to Norfolk, I find from Mr. J. H. Gurney, of Northrepps (near Cromer), and others, that there have been noticed some twelve or more of this species, as well as common Buzzards. He has three alive which have been caught in this neighbourhood (Cromer), and some have been picked up dead on the shore near Yarmouth. Mr. Gurney believes that all the larger Hawks are young birds of this year.”

Mr. R. M. Christy, of Saffron Walden, sent the following under date October 26th, 1881 :—

"NOTES ON THE OCCURRENCE OF THE HONEY BUZZARD (*P. apivorus*) AT GREAT CHESTERFORD, AND AT SAFFRON WALDEN, ESSEX; AND OF A COMMON BUZZARD (*Buteo vulgaris*) IN SHORTGROVE PARK, SAFFRON WALDEN.

"It appears that a considerable number of the larger birds of prey have been killed this autumn during their southward migration. No less than three Buzzards (two Honey Buzzards and one Common Buzzard) have been shot within a short distance of this town, and, through the kindness of our member Mr. J. Travis, to whom two of them were sent for preservation, I am enabled to give the following short account of them :—The first Honey Buzzard was shot, as briefly recorded in the 'Field,' in the Rectory Garden at Great Chesterford, on September 26th last, by Mr. G. Ernest, a son-in-law (?) of the Rev. E. Seymour Randolph, the clergyman there. According to his account the bird rose from near a large wasps' nest, but that it had been feeding on either the wasps or their grubs I very much doubt, as Mr. Travis and I, on examining the contents of its stomach, found nothing of the kind. The substance we met with was not in a very recognisable condition, but it appeared to consist principally of the remains of grasshoppers, with small beetles, and probably some other insects intermixed. The bird is, I think, a young male; the body was coated thickly with fat; the sides were brown, and the legs and cere bright yellow. The plumage is of an almost uniform reddish brown colour, scarcely varied except by some darker bars across the tail, and a whitish tip to each of the feathers in it. There is also a greyish tinge on the feathers in front of the eye. This bird is certainly the most un-hawk-like of all our Falconids. The head and beak are small; the latter being very neatly formed and sharp, and nearly black in colour. The wings are small even for a Buzzard, and the claws weak and very slightly hooked. The sternum does not exhibit any noticeable peculiarity when compared with that of other Buzzards, though the keel is rather deeper. Its structure generally is well adapted to its necessities and mode of life.

"Of the other Honey Buzzard I can give but little information. It was shot about the same time as the one above referred to, by one of Lord Braybrooke's keepers, near the aviary at Audley End. As it is now being stuffed in London for His Lordship's collection I do not know its age or sex, but it is stated to have been rising from a wasps' nest when shot at and killed.

"The Common Buzzard was shot by one of the keepers in Short Grove Park, close to Saffron Walden, about the 5th or 6th of October; it is a handsomely plumaged male bird, which Mr. Travis has mounted. In its stomach I found the remains of a rat, and there was more of the same substance in the crop, from which Mr. Travis had previously taken a couple of Field-mice.

"While upon the subject of Hawks, it will, I think, be as well to give a few particulars which Mr. Travis has been good enough to furnish me with concerning several which have been shot in this neighbourhood in years gone by, and which have never been recorded, or only very inadequately.

"The first of these is a Honey Buzzard which was seen several times about a certain spot near Littlebury Green, one September about five years ago, and was at last shot by Mr. Newman, of Strethall Hall, bailiff to Mr. Edmund Emson, in whose possession it now is. When shot it was as usual engaged upon a wasps' nest. It seems to have been an old male bird, with bright yellow irides, and its cheeks ashy coloured, but otherwise much the same in plumage as the one already described.

"Forty years ago Mr. Travis himself, then a resident close to the aviary at Audley End, was sitting at breakfast one morning during the last half of September, when he saw a large hawk fly by, and, following it immediately with his gun, soon shot it as it sat upon a tree. No particulars seem to have been preserved with respect to it, but it was probably an old bird, as Mr. Travis remembers having noticed the bright yellow of its eye as it lay upon the ground. Shortly after, perhaps a week or a fortnight, a man named Colman, a brickmaker, shot another almost exactly at the same spot. Mr. Travis stuffed them both; the first is now in Lord Braybrooke's fine collection, but the second has been sent to the North of England. Mr. Travis further says that nearly fifty years ago another was shot at Newport, but that now-a-days individuals are exceedingly few and far between in this district. He also wishes me to mention that three years ago he stuffed for Lord Braybrooke, in whose collection it now is, a splendid Kite which had been trapped by Chandler, the head-keeper, on the edge of Pounce Hall Wood, about a mile from Saffron Walden.

"As already mentioned, a most unusual number of the larger hawks, principally Honey Buzzards, have been killed since the middle of September—three numbers alone of the 'Field,' which appeared lately, making mention of about fifty; some in the northern counties, but by far the greater number in the eastern counties, Essex, Norfolk and Suffolk,—while many more are doubtless only recorded in local newspapers and other ephemeral publications. It seems that Buzzards and many of the other Hawks are only summer visitants to this country and that they are generally seen at the times of their spring and autumn migration—rarely during the spring, as they then mostly go north by some other route; but in the autumn they are more frequently observed, because both old and young birds are moving, and for some reason or other their path then lies through England. It would be interesting to have the opinion of our member Mr. Harting, or some other competent person, on the cause of their appearance this autumn in such very unusual numbers.

"I am but too well aware that it is perfectly useless to make a merely verbal protest against the shooting of these interesting and much abused birds, which are so rapidly being exterminated for purely selfish reasons, or no reason at all. In most cases they are killed by ignorant game-keepers, though, in the case of the Honey Buzzards, which have come in for such particularly rough usage this year, there can surely be no hawks which are less destructive to game. If we wish to do anything in this matter we must agitate for a serviceable 'Wild Birds' Protection Act,' framed by practical ornithologists, and not by game-preserving landlords, or mere lawyers, unacquainted with the necessities and facts of the case. The present act is incapable of effecting much good in a matter in which all lovers of Nature are so deeply interested; it can be evaded with little fear of detection, and it leaves our raptorial birds at the mercy of the landowners to be destroyed at all stages of their life in the supposed interests of their selfish pleasures. Although scarcely a year old it has already been amended by another Act, and even now it is practically little better than the three miserably inoperative pieces of legislation it was intended to supersede and improve. I rejoice to hear that there is one district in Essex at least where such a pleasing and harmless bird as our Honey Buzzard may show itself without fear of being shot down: long may the Conservators of Epping Forest enforce and extend their enlightened protection of the innocents."

Mr. W. White recorded the occurrence of another Honey Buzzard in Essex. The bird was caught on the morning of 24th September, 1881,

on the farm of Mr. R. J. Benton, at Aveley, near Purfleet. John Peters, foreman to Mr. Benton, noticed the bird in a hedge, and, with the aid of a stick, succeeded in securing it. Peters afterwards found a wasps' nest in the hedge a few feet from the spot. The bird was kept a captive for three or four weeks, and fed chiefly on bread moistened with milk, but it pined away and died, in consequence it would seem of a lack of proper nourishment, as evidenced by the emptiness of the crop when examined. Mr. Benton had kindly presented the specimen to the Club, and it was then in Mr. English's hands for preservation. The specimen appeared to be a young female. Another Honey Buzzard was seen on Mr. Benton's farm on the same day, and has been several times noticed since. On one occasion it was being mobbed by wood-pigeons. On the 25th October it appeared in company with some carrion crows.

The Secretary read some extracts from a letter received by him from Sir Thos. Fowell Buxton, in which the writer asked whether the Club could use its influence in preventing the slaughter of all birds by keepers. No shooting is now allowed by the Conservators in Epping Forest, and on his own land Sir Fowell had allowed no killing of raptorial birds for years past. It will be very interesting to observe the effect of this prohibition after some time, and it would add greatly to the value of the experiment if the same rule could be enforced throughout the valleys of the Roding River and Cobbin Brook.

The consideration of Sir Fowell Buxton's proposal was deferred until a future meeting of the Society. Votes of thanks were passed to Sir Fowell Buxton, to Mr. Christy, and to Mr. White, for their communications.

The meeting then resolved itself into the usual *Conversazione*, at which, in addition to Mr. Fitch's collection of galls and gall-wasps, Mr. E. M. Holmes exhibited and presented to the Club some typical specimens of British Mosses; Mr. Travis a rabbit's head, showing abnormal growth of the incisor teeth; and he presented to the Club the curious nest of a Nut-hatch, described in the 'Transactions,' i. 69. Mr. English exhibited and presented a Kestrel from Epping Forest, and some specimens of the Wood Cud-weed (*Gnaphalium sylvaticum*) from Monk Wood; Mr. W. White a collection of chalk fossils from the "Globe" quarries, at Little Thurrock, Essex, and some coal-period fossils; and Mr. Oxley and Mr. Letchford exhibited under the microscope various forms of Infusoria, including *Lymnias ceratophyllii* and *Stephanoceros Eichornii* and others. The objects found during the excavation of Ambresbury Banks were exhibited, together with the large plans prepared for General Pitt-Rivers's lecture on the Camp before the British Association at York.

SATURDAY, NOVEMBER 26TH, 1881.—ORDINARY MEETING.

The 22nd Ordinary Meeting was held at the Head Quarters at 7 o'clock, the President in the Chair.

The specimen of the Honey Buzzard referred to by Mr. White, at the last Meeting, was exhibited, preserved in admirable style by Mr. English. The thanks of the Club were voted to Mr. Benton and Mr. White for this very welcome donation to the Museum.

Mr. Roberts and Mr. Letchford were chosen Auditors of the Treasurer's accounts.

The following were elected members of the Club:—Messrs. E. J. Bentley, James Douglas, C. T. Pearce, M.D., J. C. Shenstone, F.R.M.S., and C. Greville Williams, F.R.S., F.C.S.

The Secretary said that the Council had considered the question of the proposed Tramways in the Forest, but had deferred passing any special resolution pending the receipt of further information as to the exact route the tramways proposed to take. He pointed out that the plans must be deposited by the 30th November, and they would then be in possession of positive information as to the parts of the Forest intended to be cut up in the interests of a few private speculators. He thought they might assume, remembering the very active opposition to the Railway Scheme of last year, that the Society would be opposed to any tampering with the Forest, especially in the northern section. The southern part was unhappily being rapidly delivered over to the publicans, showmen, and roughs, but they both as individuals and as a Society ought to do all they could to preserve the northern parts from desecration. Beyond a mere claim of justice and fairness, he thought that they had a very clear legal ground on which to stand. The Epping Forest Act was perfectly explicit. It was there laid down that Epping Forest was to be so preserved that it should retain for ever its character as a *forest*. The ground had been secured to the public at an immense cost, and he thought that they would be only acting in accordance with their own feelings, and he might say also in agreement with the feelings and requirements of the bulk of intelligent Londoners, and within the clear meaning of the law, in demanding that the Forest should be kept as a piece of untouched woodland, without encroachments or innovations by tramways, railways, hotels or other forms of speculation. [Applause.]

The President said that being so interested in the Forest, they had of course a clear right to express an opinion on a matter so nearly affecting the welfare of the district. When they had more definite information to go upon he hoped the weather would be a little more favourable, and that members would muster strongly, so that the whole subject might be thoroughly discussed.

In commencing the scientific business of the evening, the President directed attention to the specimens of Fungi from the Forest, fifty species in all, which had been preserved for the Club's Museum by Mr. English, in fulfilment of an order from the Secretary. They were capital specimens, and would form a nice nucleus for a collection of the Fungi of Essex, which he hoped ere long to see in their Museum.

The Rev. W. Linton Wilson read the following note on some Tadpoles which he had had in his Aquarium since the early summer, and which were still true tadpoles, not having changed into frogs:—

"On June 25th last year the Club did me the honour to hold a meeting at Oakhurst, Chigwell. On that occasion I had a number of tadpoles of the Common Frog in a bell-glass. They were very lively and well, living in the broad daylight among starwort, duckweed, ivy-leaved duckweed, and water crowfoot, and accompanied by fresh-water mussels, snails, newts, boatmen, beetles, a good many larvæ, shrimps, and mites. Some of them had already developed their hind legs, others were not so forward.

"I am writing on the 7th of January, 1882, and many of those tadpoles are still tadpoles, and little tadpoles too!

"They ought of course long ago to have developed true lungs, to have absorbed their fish-like gills, to have produced first the hind legs, and then a fortnight later the fore legs, and finally they ought to have absorbed their tails. Then they would have continued to live as frogs, and left the water, to return to it only occasionally. They have not grown, they have not developed. And I am inclined to think that one or two of them that had at one time put forth a little bud for their hind legs, gradually absorbed it again and returned to the first tadpole stage.

"In order to try whether a change of condition would induce any further growth or development, on the 1st of December I removed four of them to a vessel having a sloping bottom so arranged that the animals could get out of the water if they chose to do so. In a fortnight they were all dead. The remainder continued to live in the bell-glass.

"The glass has always had an abundant supply of floating weed, and an island of cork. But the water has been about four inches from the top, and has remained unchanged since June 12th, except that on the 1st of December we added four or five gallons of well-water to it, to make up the loss by evaporation."

Mr. Lockyer remarked that he recollected seeing, when at Oakhurst, in June last, a very thick growth of duck-weed on the top of the water in the aquarium, and he suggested that this dense growth might have interfered with the well-being of the little animals, perhaps by shutting off the necessary supply of free atmospheric air.

Mr. W. Cole called attention to the fact, possibly bearing upon the subject then under discussion, that frogs (very small ones) were often seen in gardens free from water, and so surrounded by walls that it was difficult to see how they could have wandered in from any neighbouring pond. He suggested, as a possible solution, that under certain conditions the whole larval life of the creature might be passed within the egg, the

* An instance of retarded development in tadpoles of the Smooth Newt (*Lisotriton punctatus*) is recorded by Mr. G. T. Rope in 'Zoologist' for April, 1883 (vol. vi. 3rd ser. 182.) The facts noted by Mr. Rope are very similar to those observed by Mr. Wilson.—Ed.

aquatic free larval stage being consequently altogether suppressed.* It was well known that in certain species of *Batrachia*, as for instance the Surinam Toad (*Pipa Americana*), the eggs are carried about by the female until hatched into young toads, and the tadpole stage is passed within the egg. And an American species of Tree-frog (*Hylodes*) lays its eggs in the axils of leaves, where only a few drops of water could at any time collect.

The President said that he had listened to Mr. Wilson's observations with very great interest. The phenomenon described he had long believed to occur, but Mr. Wilson's was the first direct evidence on the point he had met with. He entered into a full explanation of the bearing of the instance observed upon the known facts with respect to the development of some species of *Urodela*, in which the larval form is a perfect animal (*Axolotl*) and one capable of reproduction, but which, under certain conditions, becomes transformed into a creature formerly placed in quite another genus (*Amblystoma*). It was very interesting to find in our native species of *Batrachia* a tendency to retain permanently the larval form, and he hoped Mr. Wilson would institute some experiments to discover, if possible, the nature of the conditions leading to this abnormal retardation of development. From Mr. Wilson's account he gathered that the tadpoles could not land, and he would suggest that possibly free access to land so as to be enabled to breathe air was necessary for the development of the lungs, and consequently, by correlation of growth, for the appearance of the perfect animal.

Mr. Wilson promised to make some experiments as suggested. His own impression was that plentiful and suitable food was necessary for due development. The water in the bell-glass had evaporated to about half; it was clear and healthy, of a brown colour like a dark topaz; the weeds were bright green and in vigorous growth. But he fancied that the want of plentiful and varied food had so far discontented the tadpoles that they had neglected their proper functions and failed in their duty to Nature! As an instance of the adaptability of *Batrachians* to varied conditions, he might mention that in years gone by he had seen, in a dry stone quarry, pale yellow slender newts shrivelled and dried up to an inch and-a-half in length, bones and all, and yet alive; the same newts that in a wet season, when the stone quarry stood three feet in water, were of a dark fine colour, and wriggled their graceful way through the rocky pools, active and well, measuring seven or eight inches in length.†

* Since the above meeting Mr. Meldola has reminded me that in the European Land-Salamanders (which are ovo-viviparous) the larvæ, when born, have sometimes lost their external branchiæ, and that in *Salamandra atra* the entire branchiate stage is passed within the body of the mother. As, however, these *Urodela* are normally ovo-viviparous, while the *Anoura* are oviparous, the fact does not much aid my suggestion, and I am bound to say that I am not able to point to any positive confirmatory observations. I shall be very glad of information.—W.C.

† A valuable discussion of the whole subject will be found in Mr. Meldola's translation of Dr. Weismann's 'Studies in the Theory of Descent,' London, Sampson Low, Marston and Co., 1882. Vol. II. pp. 555—633.—Ed.

Mr. J. A. Finzi exhibited under the microscope some young larvæ of Noctuæ, which he had mounted in balsam in order to test the statements contained in Mr. Meldola's paper [Trans. ii. 19.] Many species in the newly-hatched stages were found to be very geometriform, and this was especially well shown in the case of the larva of the pretty moth *Cosmia diffinis*.

The President made some remarks upon the interesting nature of the facts demonstrated by the specimens Mr. Finzi had shown them, and he hoped that their entomological members would work at the subject.

Mr. B. G. Cole exhibited, as an instance of the extreme mildness of the weather, a fine specimen of the Copper Butterfly (*Polyommatus Phleas*) which he had caught flying near Fairmead Bottom on November 13th. Mr. W. Cole remarked that on the same day he had noticed twelve or fifteen species of common wild plants in vigorous bloom.

Mr. F. H. Varley exhibited two specimens of the "Swallow-tailed" Butterfly (*Papilio Machaon*) bred from pupæ found attached to the stems of an Umbelliferous plant (possibly *Peucedanum*) growing near the banks of the Thames between Southend and Tilbury, Essex, in October, 1868. Five pupæ were found, three of which emerged as butterflies in April of the following year.

The President remarked that these specimens were of great interest, as they were veritable Essex "swallow-tails." The members were well aware that the insect still bred in the fen districts of Cambridgeshire and elsewhere, but it was thought to be extinct in Essex. It was a curious fact that in this country the butterfly was very rarely seen far away from its congenial fen-lands, but on the Continent it was a common garden insect in many places, and occurred in perfectly dry districts.

Mr. W. Cole called attention to a statement by the late Edward Newman, that *P. Machaon* was found commonly as near London as Tottenham, in the early part of this century. Mr. Newman wrote in his 'Natural History of all the British Butterflies,' published in 'Young England,' that when at school at Tottenham [probably before 1812] he had found the beautiful caterpillars of the butterfly feeding upon rue. A member of the Club, Mr. G. H. Raynor, had recorded the occurrence of *Machaon* at Maldon, in 'Entomologist' for October, 1872 (vol. vi. 223). It was caught by Mr. Gutteridge, Surgeon, in Maldon, about the beginning of August, 1872. The writer adds:—"It does not seem possible that the insect could be a bred one escaped, as there is but one entomologist in the town who does not plead guilty to having had any *Machaon* pupæ this year. The marshy nature of the surrounding district renders it not improbable that *Machaon* may breed regularly in some sequestered nook near here." In a letter to the Secretary, dated November 12th, 1881, Mr. Raynor comments upon this:—"I had only just gone to live at Maldon then, and did not know much about the Essex marshes, which I have since examined more thoroughly. I do not now think it probable that *Machaon* breeds

near Maldon, although it may have done so some years since." Mr. Cole added that the value of Mr. Varley's specimens lay in the fact that, as the *pupæ* were obtained in their natural habitat, the insects must have bred there, and were not the result of an importation by some enthusiastic lepidopterist.

Mr. English remarked that between the years 1848 and 1850, the late Mr. Doubleday turned out a number of *Papilio Machaon* in parts of the Epping Forest district, as well as *Callimorpha dominula*, but the butterfly did not establish itself.

The Secretary read some extracts from a letter received from Mr. R. M. Christy, concerning the earlier stages of *P. Machaon*, which he had observed in Wicken Fen, Cambridgeshire. "It is strange that the eggs are more easily procured than the caterpillars. They are little shiny white, semi-transparent globules, and are deposited singly on the leaves of the *Peucedanum palustre*, or Hog's Fennel, growing so abundantly in the fens. When about a quarter of an inch long the caterpillar is almost black, with a large white spot on its back about the centre of its body. It is also very much bigger at one end than the other. At its various moults it gradually becomes more and more like the brightly striped, black and green, full-grown caterpillar."

A "List of the Hymenomycetal Fungi of Epping Forest," was communicated by Dr. M. C. Cooke [Transactions, ii. 181]. The list enumerated 199 species.

Mr. English remarked that his own researches would enable him to largely increase the list, and he promised to prepare a catalogue of those species he had himself gathered in the Forest districts, and send it to the Secretary.

Mr. J. Travis, of Saffron Walden, communicated the following records of a few rare birds caught in Essex, received by him recently for preservation:—

(1) RED-NECKED PHALAROPE (*Phalaropus hyperboreus*), taken October 14th, 1881, on the lake at Debden Hall, near Saffron Walden. An old male in winter plumage.

(2) LARED GREBE (*Podiceps auritus*), taken at the same time and place after an hour's chase on the lake. A young male bird in poor condition. Its stomach contained a rounded and flattened mass of feathers—presumably its own—mixed with remains of small fish.

(3) CORMORANT (*Phalacrocorax Carbo*). Two young specimens taken by Mr. H. Webb, Streetly Hall, near Wickham, on September 7th.

(4) BUFFON'S SKUA (*Lestris Buffonii*). A specimen was picked up in an extremely emaciated condition near Wimbish, about the beginning of November, 1881. [From a subsequent letter from Mr. Travis.]

The thanks of the Society were returned to the authors, and the usual conversazione concluded the Meeting.

SATURDAY, DECEMBER 17TH, 1881.—ORDINARY MEETING.

The 23rd Ordinary Meeting of the Club was held at the Head Quarters at seven o'clock, the President in the Chair.

Donations of books were announced from Mr. B. G. Cole (2 vols.), and Miss J. Combs. Mr. English presented to the Museum ten species of Fungi belonging to the genera *Polyporus*, *Dædalea*, *Trametes*, and *Stereum*, preserved by his well-known process; Mr. F. H. Varley the two specimens of *Papilio Machaon* referred to at the last Meeting; and Mr. Harcourt intimated his intention of presenting a collection of the Flowering Plants of the Forest, then being preserved by Mr. English. Cordial votes of thanks were passed to the respective donors.

Mr. R. B. Green and Mr. E. G. Varenne were elected members of the Club.

In accordance with the Rules the President announced that the following vacancies had occurred in the Council:—Dr. Aveling (resigned), Mr. Copland (resigned), Mr. Andrew Johnston (nominated as Treasurer), and Mr. B. G. Cole (nominated as Assistant Hon. Secretary).

To fill the seats so rendered vacant, the following members were proposed:—Mr. H. J. Barnes (on vacating office as Treasurer), Professor Boulger, F.L.S., F.G.S., Mr. Arthur Lister, J.P., F.L.S., and the Right Hon. Lord Rayleigh, F.R.S. (Prof. of Experimental Physics at the University of Cambridge).

To fulfil the requirements of Rule III., the following members of Council agreed to retire, but offered themselves for re-election:—Mr. Godwin, Mr. Harcourt, Mr. R. L. Barnes, and Mr. Roberts.

As Officers for 1882 the following gentlemen were nominated:—President, Raphael Meldola, F.R.A.S., F.C.S. (Vice-President of Entomological Society); Treasurer, Andrew Johnston, J.P., D.L. (late High Sheriff of Essex); Secretary, William Cole; Assistant-Secretary, B. G. Cole; Librarian, Alfred Lookyer.

The Secretary, on behalf of the Council, gave notice of his intention to move at the Annual Meeting the following additions to the several Rules mentioned:—

In Rule I., after title of Club, to add the words "*and its short title shall be 'THE ESSEX FIELD CLUB'*"; in Rule III., after the word "*Secretary*" in Clause i., and throughout the Rules, to add the words "*Assistant Secretary*"; at the end of Rule VII. to add the words "*and the names of Members so in arrear may be suspended in the rooms of the Club*"; at the end of Rule XI. to add the words "*and Members not so resigning shall be liable for the subscription for the year next ensuing.*"

The Council thought it unwise, at present at least, to alter the legal title of the Club, but the above addition would perhaps meet the objection which had been raised in some quarters, that the full title of the

Club was too local, inasmuch as the operations of the Society embraced the whole county.

Before the commencement of the scientific business of the evening the President alluded in feeling terms to the death of an honoured original member of the Club, Sir Antonio Brady, F.G.S., who died on Monday morning, December 12th, at his residence, Maryland Point, Stratford, at the age of 70. He was sure he was but expressing the desire of all members of the Society in suggesting that a letter of condolence should be sent to the family expressive of their respectful sympathy, and their deep sense of the loss geological science and the county generally had sustained by the death of their distinguished member. He might add the Secretary had suggested that the Club should publish in the 'Transactions' a short memoir of Sir Antonio, accompanied, if possible, by a portrait. To thus record departed worth was in his (the President's) opinion a very commendable custom, and one which obtained in many Societies, especially on the Continent, and he thought they might well initiate it in their own Club.

The resolution was passed unanimously.

Mr. White exhibited an aberration in a specimen of *Thecla Quercus* (the "purple hair-streak butterfly"). The specimen was a female, and on the dark purplish brown disc of the fore wings two or three blotches of an orange colour were clearly traceable, suggesting a relation of affinity with another well-known butterfly of the same genus,—*Thecla Betula*,—the female of which has a large orange patch on the fore wings. Mr. White thought that such instances of departure from type were well worthy of careful attention, as by the aid which they afford in elucidating the least apparent cases of affinity, and in determining more exactly the "cousinship" of species, they always yield some evidence of value to the evolutionist. He thought that from an examination of the specimen they might fairly conclude that *Thecla Quercus* was a younger form of butterfly than its sloe-feeding ally. He also exhibited a collection of British species of *Sesiidæ* or "Clear-wing" Moths, in order to show the close general resemblance in many cases between these delicate creatures and other insects which possess special means of defence, such as bees and wasps.

In most of the species of the family the scales upon the wings, so characteristic of the order Lepidoptera, are almost entirely absent, but one of Mr. White's specimens of *Sesia fuciformis* which he had bred from the pupa, still retained some scales. These scales generally fall off readily when the insect flies. One section of the family (the genus *Macroglossa* for example) has wings densely clothed with scales, and the President pointed out the interest attaching to the specimen exhibited as showing that the "clear-wing" character was a later development, tending to the advantage of the creature in assimilating its appearance to the well-protected Hymenoptera, whilst its origin from a densely scaled form was indicated by the transitory retention of scales in the recently perfected

moth. The President also stated, with reference to the aberration of *T. Quercus* exhibited by Mr. White, that the orange patch on the wing, as possessed by *T. Betula*, was a very common kind of ornamentation in the genus *Thecla* and its allies; he was therefore disposed to think that this form of marking was the oldest, and that Mr. White's insect was an example of a partial case of reversion to a former character.

In the discussion which ensued Mr. English and Mr. B. G. Cole both stated, as the result of their experience in breeding *Sesia fuciformis* from the caterpillar, that the possession of scales upon the wings of the fresh imago was a very variable character, not one-third of the brood having them, but in some exceptional instances the clothing upon the wings was quite dense.

Mr. English communicated a list of the Fungi of Epping Forest, supplemental to that received from Dr. Cooke at the last meeting. [The species of the Family Hymenomycetes noted by Mr. English are incorporated in the list published in the 'Transactions,' ii. 181].

Mr. English enumerated 312 species of the larger Fungi, belonging to the following Orders:—Agaricini (188), Polyporei (43), Hydnei (8), Auricularini (16), Clavariæ (10), Tremellini (3), Hypogæi (1), Phalloidei (2), Trichogastres (9), Myxogastres (8), Nidulariacei (3), Elvellacei (21). The author thought that the lists presented—Dr. Cooke's and his own—were but tentative, and did not record anything like the number of species actually existing in the Essex woodlands. For instance, in the order Agaricini, or gill-bearing Fungi, he had recorded 188 species, but in all probability future work would double this number, for in the extensive sub-genus *Tricholoma* only 21 species had been observed yet in the district, whilst the number of British species amounted to about 60. Very little attention had been paid to the *Mycena* group; it consisted mostly of small delicate plants, such as were represented in the Club's collection by *Mycena lactea*; here Mr. English could record only six species although more than 70 had been catalogued as British. In the genus *Cortinarius* he could only give the names of 15 species with certainty, but he had observed at least three times that number, most of them not yet determined, and the known native species exceeded 100. He was confident that the record of 11 species of *Hygrophorus* should be doubled. From some unknown cause during the last two years the *Hygrophori* had been remarkably scarce, only four or five species having been seen. Many species of this genus could not be overlooked; for instance, *H. virgineus*, a fungus of pearly whiteness, with gills running down the stem, loved to grow in open grassy spots by the forest sides, and was always a striking object. Then *H. mirriatus*, with a brilliant crimson and orange pileus and gills, grows in heathy places partly covered with bracken, with its companion *H. ceraceus*, the latter of a beautiful clear yellow. At the same times and places the botanist could meet with *H. psittacinus* or Parrot Toadstool, which, when young, is of a fine green colour, pileus and stem alike, but as it advances to maturity gains gradually a bright tint of orange; in all stages the plant is glutinous. The little *H. Houghtoni*,* for the second time recorded as British, occurred in Loughton Forest on October 1st, and was exhibited at the "Fungus Foray." Mr. English also found another *Hygrophorus* on that day, very distinct, but scarce

* It appears to be impossible to separate this from *H. latus*, Fr., of which it seems to be only a condition, scarcely even a variety.—M.C.C.

and local; he had placed it in Dr. Cooke's hands to work out; probably it would prove to be a new species.

The Epping District seems most favourable for the growth of the *Lactarii*; the speaker could record twenty species, and sixteen of the genus *Russula*. Here the young botanist had a wide field for research, a great reason for the exercise of the utmost care in his determinations, the species being very numerous and very perplexing even to the experienced student. When rambling through Monk Wood in the autumn in search of Fungi, they might often encounter an ochraceous *Russula*, which had long proved very puzzling both to the speaker and to Dr. Cooke. It was only during the week of the Club's last "Foray" that that *crux* was overcome by Dr. Cooke, and the ochraceous plants resolved into three distinct forms—*Russula ochroleuca*, *R. citrina* and *R. fellea*.

Mr. English had met with fourteen species of *Boletus*, but they could not all be met with in one season. He had gathered a specimen of *B. satanas* nine inches in diameter across the pileus, and some specimens of *B. piperatus* only an inch in diameter. The most brilliant forest species was *B. rubinus*, which was also the scarcest.

The genus *Polyporus* was pretty well represented, twenty-four species being recorded as inhabitants of their woodland districts. The species presented more diversity of size and form than did those of preceding genera. *P. squamosus* was a good example. Mr. English had gathered a specimen over eighteen inches in diameter, but "Dr. Greville mentions an instance of one attaining a circumference of seven feet five inches, and weighing thirty-four pounds after having been cut four days. It was only four weeks attaining these dimensions, thus acquiring nineteen ounces per day" (see Cooke's 'Handbook'). The little *P. picipes* was an interesting plant, having a black stem, white pores, and a frondose appearance unlike any other he knew. He had only met with it on two occasions; like many other species it was only to be found in certain years, and under very favourable circumstances. This remark applied to other species of Fungi. Soon after the charcoal burning had ceased in the Forest many species cropped up. *Agaricus carbonarius* could then be seen by thousands, but was now not to be found. *Peziza septiata*, then new to Britain, and others had now disappeared till the necessary conditions of environment once more awoke them to life; and with such changes working they might even look for the appearance of new forms and species—at least new to the Forest Flora.

The President said that he had to submit to the meeting, for its approval and confirmation, a resolution which had been drawn up by the Council to express the views of the Society with reference to certain schemes to be brought before Parliament in the Session of 1882. The resolution was as follows:—

"That this Society respectfully requests the Conservators of Epping Forest to oppose, on behalf of the large section of the population of London and others interested in the study of Natural History, any Bill in Parliament conferring upon another public body rights over portions of the land placed in their care by the Epping Forest Act, which directs that the Forest is to be preserved as far as possible in its natural aspect; and in particular to oppose the Bill of the Lea Bridge, Leyton and Walthamstow Tramways Company which proposes to obtain permanent running rights over a part of the Forest known as the 'Ranger's Road,' so depriving the Conservators of their powers over that portion of

the Forest hereafter. And that a Petition be presented to the Conservators to the above effect, and further praying that they will exert all their influence to oppose any schemes which would tend to injure the forestal character of the lands under their charge, or to destroy or disturb the *Fera Naturæ* inhabiting the same."

He thought that this resolution expressed with exactness their position as a Natural History Society, with relation to this really serious question, and he hoped that the members generally would give the matter of the preservation of the essential natural features of the Forest their earnest attention, and state their wishes with regard to the drawing up of the Petition.

The Honorary Secretary made some remarks upon the subject. The Society had been accused of selfish motives, and of a desire to keep the Forest as "a happy hunting ground" for the botanist and entomologist. He thought that the charge was very unfair. Their desire was but to see the Epping Forest Act carried out in its true spirit. It was generally agreed that the great value of the district consisted in the fact that it was a piece of primeval woodland, with the exception of New Forest, almost the last remnant of the vast forests which once covered England, and "fed alike the vassal and his lord." If once such schemes as those under consideration were sanctioned, this quietude, charm, and value of the woods would vanish, never to return. The place would be gradually given over to the speculator, publican, and swing proprietor; and in twenty years' time the woods would become a mere park, relegated to the tender mercies of the more uneducated sections of the community, to the destruction of all that made it valuable in the eyes of the true philanthropist, he who could and would look forward to the time when the existence so near London of a piece of true untouched nature would be of inestimable value in the moral and physical education of millions yet unborn. He hoped that all intelligent Londoners, whether "naturalists" or not, would consider the question carefully, and speak out emphatically while yet there was time. No parts of the woodlands were more than two miles from a railway station, and to sanction such vulgarities as tramways through a Forest was but to weakly bow to a mistaken and mischievous agitation, fomented by a few interested speculators caring more for commissions, percentages, and "bar-takings" than for the true and permanent interests and wishes of intelligent citizens.

Some suggestions were made by Dr. Pearce, Messrs. Gould, Warner, and Ross; and the resolution was passed unanimously, the President, Secretary, and Council being empowered to prepare and present petitions to the Conservators and to Parliament, and to take measures to enlist the co-operation of the various Natural History Societies in and around London in the matter.

A proposal of Sir T. Fowell Buxton, relative to the preservation of the *Fera Naturæ* in the County of Essex, was on the agenda paper; but the full consideration of the question was postponed, the members present

thinking it would be better to devote an entire evening to a subject so important.*

A paper entitled "The Mammalia of Essex," by Mr. Henry Laver F.L.S., was read by the Secretary [Transactions, ii. 157].

A long discussion on various details connected with the natural history of our native quadrupeds was carried on by the President, Dr. Pearce, Messrs. English, Gould, Cole, Lockyer, Warner, and others. The pugnacious habits of the shrew, which it was suggested might account for their being so commonly found dead on paths, &c., in autumn; the white colour of the stoat in some winters; the question of "vermin," and the assumed right of gamekeepers to destroy all animals under that name; the former existence of red deer in the Forest, and other matters were referred to. Mr. English exhibited a photograph of a remarkable aberration in colour in the common squirrel; the specimen (which was quite "piebald") had been taken in the Forest in 1858, and was now in the possession of an inhabitant of the hamlet of Ivy Chimneys, near Theydon.

Mr. Warner called attention to the fact that the otter was still found in the Lea River. A female weighing thirteen and-a-half pounds was shot in the private fishery belonging to Mr. E. J. Eastwood, King's Weir, Cheshunt, on November 20th, 1878, and was recorded in the 'Times.' Mr. Eastwood had informed him that in 1881, he (Mr. Eastwood) saw three in the same water, and that a very large one had lately been seen in the mill-stream adjoining, belonging to the Government Powder Factory, at Waltham Abbey, by some of the men employed upon the premises.

A cordial vote of thanks was passed to Mr. English and Mr. Laver for their communications.

It was announced that the Annual Meeting would take place on the 28th of January. Part 5 of the 'Transactions,' containing 88 pp. of letterpress and four plates, was on the table. The usual conversation concluded the meeting.

SATURDAY, JANUARY 28TH, 1882.—ORDINARY AND ANNUAL GENERAL MEETING.

The 24th Ordinary Meeting was held at the Head Quarters, at seven o'clock, the President in the Chair.

The Librarian announced the donation of a volume to the library by Mr. B. G. Cole, and that two volumes of the 'Transactions of the Watford Natural History Society' had been acquired by purchase.

* The matter above referred to, together with the general question of Forest management from the Natural History point of view, came on for discussion at the meeting of the Club held on February 25th, 1882. A full report has been prepared, and will be issued in the next part of 'Transactions' as an Appendix to Vol. iii., and also in a separate pamphlet form for distribution.—Ed.

Mr. Leonard Brown was elected a member of the Club.

The President stated that at the last meeting a resolution concerning the projected tramways through the Forest had been passed, and it was then decided to request their member, Sir John Lubbock, M.P., to present a Petition to Parliament against the Bill of the promoters. Sir John Lubbock had expressed his willingness to do so, but he (the President) was extremely glad to announce that further action had been rendered unnecessary by the collapse of the Tramways Bill for that Session of Parliament at least. The opposition to the scheme had been almost universal, ratepayers and lovers of the Forest equally objecting to the tramways as hurtful and unnecessary. [Loud applause].

The Secretary read a letter received from the Rev. Nicholas Brady, acknowledging the vote of condolence passed at the last meeting to Lady Brady and family.

The Meeting then resolved itself into—

THE ANNUAL GENERAL MEETING.

In accordance with the circular dated January 14th, 1882, sent to all members, the Second Annual General Meeting of the Club was held at a quarter past seven o'clock, the President in the Chair.

The Treasurer's Statement of Account for the past year was read by Mr. Roberts, one of the Auditors. [See Appendix].

Mr. John Spiller moved the adoption of the financial statement, which he considered on the whole to be very satisfactory; and he included in the motion a cordial vote of thanks to the late Treasurer, Mr. H. J. Barnes, who was abroad in consequence of ill-health, and also to Mr. R. L. Barnes, who had acted as Treasurer since his brother's departure.

The motion was seconded by Mr. Godwin, and carried unanimously.

Mr. R. L. Barnes briefly returned thanks on behalf of his brother and himself.

The Secretary read the Report of the Council for the year 1881. [See Appendix.]

Mr. Friswell in moving the adoption of the Report, alluded to the rapid increase in the number of members, and to the encouraging fact that the Club was making itself known outside the merely local sphere of its action.

The motion was seconded by Mr. F. C. Gould, and carried unanimously.

The ballot for new Members of Council and for the Officers of the Club for 1882 was then held in accordance with the Rules; Mr. F. H. Varley and Dr. Pearce acting as Scrutineers. The new Members of Council and Officers nominated at the last meeting were unanimously elected. [Applause].

[By inadvertence the formal confirmation of the additions to the Rules proposed at the preceding meeting and the nomination of two Honorary Members were not moved, but the omission was rectified.

at the next meeting, February 25th, 1882, which was made special for that purpose.—ED.]

The President then delivered his Annual Address, which, after a short review of the Club's history during the past year [Trans. ii. 192], consisted of the first portion of an essay on "The Phenomena of Cyclical Propagation in the Animal Kingdom." The lecture was illustrated by a series of large diagrams prepared for the occasion by Mr. Henry A. Cole. The conclusion of the paper will be read at a subsequent meeting.

Professor Boulger said that he had much pleasure in proposing a cordial vote of thanks to Mr. Meldola for his very able address, and he was sure all would look forward to the second part with great interest. But the facts brought forward were in themselves so wonderful and instructive that, even without the theoretical links which the author promised to supply, they furnished abundant material for thought. He might say that the phenomena commonly known as the "alternation of generations," but which had been so well re-named "cyclical propagation," were by no means confined to animals, and at a subsequent period he might venture to place before the Club some observations upon the existence of similar phases of polymorphic development amongst plants.

The Rev. W. Linton Wilson warmly seconded the vote of thanks, and Mr. F. C. Gould suggested that with it should be incorporated a grateful recognition of the value of their President's services during his years of office, and a like compliment to the Honorary Secretary for his work during the past session.

On the motion of Mr. Godwin a vote of thanks was also passed to Mr. Alfred Lockyer, the Honorary Librarian, for the capital manner in which he had gathered together a very fair nucleus of a library, and the great care shown in the arrangement and cataloguing of the books.

The votes having been unanimously agreed to, the President, Secretary and Librarian briefly returned thanks, the former also acknowledging the compliment paid to him by his being elected for the third time to fill the Presidential chair.

A hearty vote of thanks was also tendered to Mr. H. A. Cole and Miss Cole for the use of the rooms for the Library and Museum, and for the Meetings of the Club, on the motion of the President, seconded by Mr. Varley. The thanks of the Club were also given to the Auditors, Messrs. Roberts and Letchford, to which the latter gentleman responded.

In bringing the meeting to a close, the President said it was his privilege to nominate the VICE-PRESIDENTS for his year of office. He named Mr. E. A. Fitch, F.L.S., Mr. N. F. Roberts, F.G.S., Rev. W. Linton Wilson, M.A., and (by permission) the Right Hon. Lord Rayleigh, F.R.S. He also called attention to the subscription list for the "Forest Camps Exploration Fund, 1882," and hoped that the Society would be put into possession of funds sufficient to carry on the work with credit to itself and benefit to Archaeological Science.

INDEX

TO

JOURNAL OF PROCEEDINGS.

- Abraxas ulmata* in Essex, lviii.
Accentor modularis, white aberration of, iv.
Achatina acicula, xi.
 Ambresbury Banks : Report on the Exploration of, xxviii ; plan of operations, xxix ; literature and history of, xxx ; site and surroundings of, xxxii.
 Annual General Meeting, lxxxvii.
Batrachia, retarded development of, lxxviii.
 BIRCH, G. H. : description of Waltham Abbey, vi ; history of, viii, x.
 Birds, protection of, lxxv ; rare, in Essex, lxxx.
 BRADY, Sir A., death of, lxxxii.
 BREE, Dr. C. R., on hawfinches in Essex, iii.
 British Association and the investigation of Loughton Camp, lxxviii.
Buteo vulgaris in Essex, lxxiii.
 Buxton, Sir T. F., on the occurrence of a Honey Buzzard in Epping Forest, lxxii ; on protection of birds, lxxv.
Cecidomyia foliorum, xx.
 CHANCELLOR, F. : history and description of St. Mary's, Chelmsford, xlvii ; of Sandon Church, li ; of Danbury Church, liii ; on ancient earthworks in Essex, lvii.
 Chelmsford, visited, xlvi ; St. Mary's Church, xlvii ; flowering plants in neighbourhood of, l.
 Chigwell, visited, xxiv ; history of, xxiv ; derivation of name, xxv ; St. Mary's Church, xxxvi ; celebrities of, lxxvii.
 CHRISTY, B. M., on *Cyclostoma elegans*, xxi ; on the Honey Buzzard and Common Buzzard in Essex, lxxiii ; on early stages of *Papilio Machaon*, lxxx.
Claytonia perfoliata, introduction of into Essex, li.
Coccothraustes vulgaris in Essex, iii.
 COLE, B. G., on *Sesia fuciformis*, lxxxiii.
 COLE, H. A., on worked flints from Parndon and High Beach, lviii.
 COLE, W., presentation to, i ; on observing larvæ, v. ; on tramways in Epping Forest, lxxvi, lxxxv ; on retarded development of *Batrachia*, lxxvii ; on *Papilio Machaon*, lxxix.
 COOKE, Dr. M. C., on the Fungi of Epping Forest, lxvi.
Coprinus aratus from Epping Forest, lxiii ; cystidia of, lxiv.
 Council for 1882, lxxxi, lxxxvii.
 CROUCH, W., on *Cyclostoma elegans*, xi ; on museum specimens, lix ; on the Mollusca of the Roding Valley, lix.
 Cyclical propagation, lxxxviii.
Cyclostoma elegans, xi, xxi.
 DALTON, W. H., on *Cyclostoma elegans*, xi.
 Danbury, visited, xlvi ; the church, liii ; ancient camp at, liv ; notes on the natural history of, liv.
 Deer of Epping Forest, xxi, xxii.
 Dene-holes at Grays, xviii.
Dianthus, fasciation in, vi.
 Diatoms. Desmids and Algæ from Epping Forest, xlii.
 D'OTLEY, W., on the deer of Epping Forest, xxii.
Dulcranum glaucum in fruit, vi.
 Elm, large, at Waltham Abbey, vii.
 ENGLISH, J. L., on hawfinches, iv ; on adaptation in *Ranunculus aquatilis*, xl ; on *Sesia fuciformis*, lxxxiii ; on the Fungi of Epping Forest, lxxxiii.

- Epping Forest and Great Eastern Railway, v.; deer of, xxi, xxii; excavation of Ambresbury Banks, xxviii; visited, xli, lx; *Algae* desmids and diatoms from, xlii; Neuroptera from, xlii; Microzoa from, xliii; Hepaticæ, lichens and mosses from, lxv; Fungi of, lxvi, lxxxiii; proposed tramways in, lxxvi, lxxxiv, lxxxvii.
- Epping to Theydon Garnon, xliii.
- Essex and Chelmsford Museum, 1.
- Essex, rare birds in, lxxx.
- Fasciation in *Dianthus*, vi.
- Field Meetings: Waltham Holy Cross, vi; Grays Thurrock, xiii; Camp exploration, xxviii; Chigwell, xxxiv; Epping Forest, xli; Epping to Theydon Garnon, xliii; Chelmsford and Danbury, xlv; Annual Cryptogamic Meeting, lx.
- FITCH, E. A., on analogies, causes and growth of galls, lxx.
- Forest Camps Exploration Fund, xxviii, lxxxviii.
- FRIES, E., MS. of, iii.
- Fungi of Epping Forest, lxvi, lxxxiii.
- Fungus Foray, lx.
- Gall new to Britain, xvi, xx.
- Galls in relation to the animal kingdom, lxix, lxx; causes and growth of, lxx.
- Geologists' Association, joint field-meeting with, xiii.
- GIBBS, J., on tri-morphism of *Lythrum Salicaria*, 1; flowering plants in neighbourhood of Chelmsford, 1; introduction of *Claytonia perfoliata* into Essex, li.
- Gnorimus nobilis*, lviii.
- Gordiacea, life-history of, iii.
- Gordius aquaticus*, iii.
- Grays Thurrock, visited, xlii; bibliography of the geology of, xix.
- Great Baddow, visited, 1.
- Great Eastern Railway and Epping Forest, v; concession as to fares, xlv, lv.
- HARTING, J. E., on the deer of Epping Forest, xxi.
- Hawfinch in Essex, iii; food of, iv.
- Hedge Sparrow, white aberration of, iv.
- Hepaticæ from Epping Forest, lxv.
- Herts Natural History Society, joint field-meeting with, xli.
- HOLMES, E. M.: Hepaticæ, Lichens and Mosses from Epping Forest, lxv; on Lichens, lxvii.
- Honey Buzzard and Common Buzzard in Essex, lxxii, lxxiii, lxxiv.
- Hunstanton and its neighbourhood in 1878 and 1880, v.
- Hylurgus piniperda*, iv.
- Inflorescences, classification of, xlv.
- JERVOISE, Sir J. C., on "pot-boiler" flints, ii.
- KING, J. J., on Neuroptera from Epping Forest, xlii.
- Lea River, Otters in, lxxxvi.
- Lepidoptera, organs of smell in, xii.
- LETCHFORD, R., on galls, lxx.
- Leyton, *Ostræa* from, xii.
- Lichens, from Epping Forest, lxv; distribution, etc., of, lxvii; Schwendenerian theory of, lxvii.
- Liparis auriflua*, dwarf specimen of, lviii.
- Loughton Camp, investigation of, lxviii.
- Lythrum Salicaria*, tri-morphism in structure of flowers of, 1.
- MELDOLA, R., on *Cyclostoma elegans*, xii; on organs of smell in insects, xii, xx; on museums, xxii; on the Stone Age, xxiii; on the causes and growth of galls, lxx; on retarded development of Batrachia, lxxviii; on *Papilio Machaon*, lxxix; on *Sesia* and *Thecla*, lxxxii.
- Microzoa from Epping Forest, xliii.
- Mildness of winter, 1881, lxxix.
- Mollusca of the Roding Valley, lix.
- MORRIS, Prof. J., on the geology of Grays Thurrock, xiv, xvi.
- Mosses from Epping Forest, lxv.
- Museum, donations to, i, lxxxi; arrangement and management of, xxii.
- Neuroptera from Epping Forest, xlii.
- Oak with variegated leaves, lii.
- Officers for 1882, lxxxi, lxxxvii.
- Ordinary Meetings, i, iv, xi, xx, xxxix, lvi, lvii, lxvi, lxxviii, lxxvi, lxxxi, lxxxvi.
- Ostræa* from Leyton, xii.
- Otters in River Lea, lxxxvi.

- Papilio Machaon* in Essex, lxxix ; early stages of, lxxx.
- Parndon, Great, worked flints from, lviii.
- PEARCE, Dr. C. T., on galls, lxix.
- Pemphigus bursarius*, xx.
- Pernis apivorus* in Essex, lxxii, lxxiii, lxxiv.
- PHILLIPS, T. W., on Microzoa from Epping Forest, xliii.
- "Pot-boiler" flints, ii.
- Presentation to the Hon. Sec., i.
- Protection of birds, lxxv.
- Ranunculus aquatilis*, xl.
- RAYNOR, G. H., on *Papilio Machaon*, lxxix.
- ROBERTS, N. F., on the Stone Age, xxvi.
- Rules, additions to, lxxxi.
- Sand-pipes in chalk at Grays, xiv.
- Sandon, visited, 1 ; church at, li.
- Sesia fuciformis*, lxxxii.
- Smell, organs of, in insects, xii, xx.
- SMITH, W. G., on *Agaricus Worthingtonii*, iii ; on Dene-holes, xviii ; report of Fungus Foray, lxi.
- Sparassis crispa*, gigantic specimen of, lxi.
- Squirrel, aberration in colour of, lxxxvi.
- Stone Age, the, xxiii ; evidences of, xxiii, xxv ; divisions of, xxiv, xxvi.
- Tadpoles, non-development of, lxxvii, lxxviii.
- Thecla Quercus*, aberration of, lxxxii.
- Thera*, affected by ichneumons, xxi.
- Theydon Garnon, visited, xliii.
- Tramways in Epping Forest, lxxvi, lxxxiv, lxxxvii.
- TRAVIS, J., on rare birds in Essex, lxxx.
- UNWIN, T. F., on the history, etc., of Chigwell, xxxiv.
- Vice-Presidents for 1882, lxxxviii.
- WALKER, H.: Report of field-meeting at Grays Thurrock, xiii ; on the geology of Grays, xiv, xv, xvii ; on galls, xx, lxx ; on the Stone Age, xxvii.
- WALL, P. W., on museums, xxiii.
- Waltham Abbey, visited, vi ; description of, vi ; history of, viii ; Lady Chapel at, vii, ix ; large elm at, vii.
- WARNER, C., on Otters in River Lea, lxxxvi.
- WHITE, W., on observing larvæ, v ; on Honey Buzzards in Essex, lxxiv ; on an aberration of *Thecla Quercus*, lxxxii.
- WILSON, Rev. W. L., on retarded development of Batrachia, lxxvii, lxxviii.
- Winter, mildness of in 1881, lxxix.

ERRATA.

Page 12 line 8 (from bottom), for *Peryginæ* read *Perigynæ*.

" 27 " 14 " or " on.

" 125 " 1 " *Xenophanes* " *Potentilla* read *Xestophanes Potentillæ*.

" xviii " 14 and 46 " " *Dane-holes* " read " *Dene-holes*."

" xxxii " 17 (from bottom) " side read site.

" xxxiv heading, " JULY " JUNE.

" xxxix lines 4 and 5. A curious error has crept in here; the founder of "Fairlop Fair" was Daniel Day, a block and pump maker, of Wapping. The author of 'Sandford and Merton' was Thomas Day, of Stapleford-Abbots, near Abridge, Essex.—Ed.

Plate iv. fig. 2. The horizontal scale is ten times too great; the reader is requested to strike off a cipher from each number; the vertical scale is correct.—Ed.

TRANSACTIONS
OF THE
EPPING FOREST AND COUNTY OF ESSEX
NATURALISTS' FIELD CLUB.

I.—Is *Vanessa Polychloros* THE PROTOTYPE OF *V. Urticæ*?
A QUERY SUGGESTED BY THE ABERRANT FORM OF A SPECI-
MEN OF *V. Urticæ* OF *Polychloros* TYPE.

By WILLIAM WHITE.

[Read February 26th, 1881.]

THE caterpillar of the *Vanessa* exhibited was taken at Highgate-Hill in 1879, included in the larval "web" of a community of *Urticæ*, and was reared throughout its existence with the rest of the brood entirely upon nettle (*Urtica*). During the larval stage there was nothing notice-



able in its appearance to distinguish it in any way from its companions. In the chrysalis form it bore the specific characters of *Urticæ* as regards its angular projections and general contour, but the colours were somewhat richer in

tone than is usual, sufficiently so to attract special notice. The imago is rather below the average measure of *Polychloros* in expanse of wings, being about the usual size of *Urtica* (two inches). The insect is the only individual of the brood known to have varied, even in the slightest degree. Although I did not see every member of the brood, I can vouch for at least forty or fifty specimens, which I examined carefully, and found not a trace of variation in any single case. No larvæ of any other species of *Vanessida* were reared contemporaneously with the brood.

I have examined the antennæ of this specimen under the microscope, and find that they present the special characters found in *Polychloros*.

From these facts I make four deductions, all of which turn upon points of interest. It is from such instances of divergence as the present that we are enabled to gain some clue respecting the affinity of species known to be closely related, and for this reason I offer the following observations :—

1. As *Polychloros* lives upon elm and other trees, and *Urtica* upon nettle and low plants, the instance is valuable as affording further evidence of the fact that neither a particular food nor a change in diet affects in any way the colouring and markings of the perfect insect, so as to offer *per se* a means of originating "varieties." This conclusion is valid whether the specimen under consideration be really a *Polychloros* or *Urtica*. Many experiments upon different species of insects agree, I believe without exception, in so deciding this question.

2. On the supposition that the specimen is the product of *Polychloros* parents, it is easy to infer either that the ovum was dropped whilst the female was on the wing, or else that the young caterpillar fell from a neighbouring tree soon after emergence from the egg; in either case the accident must have occurred immediately over the *Urtica* web. As the broods of the two species rarely appear synchronously, the conjecture is scarcely to be entertained, even if the accident were probable. On such a supposition, however, it is to be deduced that (if *Polychloros*) the society of an allied species

does not affect the development of the individual, but such individuals are treated as friends. It is to be remembered, at the same time, that the larva of *Urtica* bears a much closer resemblance to *Pyrameis Cardui* than to *Polychloros* [specimens of larvæ (preserved) were exhibited for the sake of comparison.]

8. If it happen to be a hybrid¹ between the two species, it offers an instance of the fact which has been proved by Darwin and others, that in the case of hybrids between closely-allied forms the progeny, instead of assuming direct intermediate characters, inherits the characters of one or other of its parents; and that in numerical proportions varying with the circumstances. As my specimen is the only known individual of the swarm the theory is rather a lame one.

4. Lastly, on the understanding that the specimen is the development of an *Urtica* larva, we must conclude that it is a case of recurrence to a previous form, and, if so, that form was *Polychloros*; that, while *Polychloros* has not changed, the change of habitat and environment has brought about the marked variety which now constitutes a separate species in *Urtica*. In favour of this supposition I may instance the well-known fact that *V. Urtica*,² like *V. C-Album* and *P. Cardui*, varies occasionally in colour, markings, and size, whilst *Polychloros* is much more persistent—indeed almost invariable—in type, though irregular in point of size. The latter variability, however, is common to all classes of animals at any given period.

This persistency of type argues an antiquity beyond that of its allies, and makes it appear highly probable that *V. Polychloros* is the ancestral prototype of *V. Urtica*.

[In connection with Mr. White's paper, it may be interesting to quote the following record of a similar experience

¹[The Rev. G. H. Raynor records ('Entomologist' vi. 221), finding a specimen of *V. Urtica* in coitu with *V. Polychloros*.—ED.]

²Newman, in his 'British Butterflies,' gives woodcuts of four aberrations of *Urtica*, but not one of *Polychloros*; nor does he instance any variation in the latter species.

given in the 'Entomologist' vi. 88 :—"In the spring of last year I took the larvæ of what I considered to be *V. Urtica* feeding on nettles, and from time to time added other larvæ of *Urtica* in the same breeding-cage kept for nettle-feeders only; to my surprise a number of the imagos resembled *Polychloros* in colour and markings, keeping the size of *Urtica*. I submit them to you for your remarks. There was no apparent difference in the larvæ that I observed while feeding.—JAMES A. TAWELL, Earl's Colne, March 11th, 1872." The late Mr. Newman headed this note "*Polychloros* Larvæ feeding on Nettle," and described the butterflies as follows :—"These specimens have a wonderful similarity to *Urtica*, which they do not at all exceed in size; still the colour is nearer to that of *Polychloros* than that of *Urtica*; and the black spot at the anal angle of the fore wing is present, as in *Polychloros*; the white spot on the costa of *Urtica* is absent, also as in *Polychloros*." Some of these specimens were presented to Mr. Newman, and, as we are informed by Mr. B. T. Lowne, are now in the collection of the Entomological Club.—ED.]

DISCUSSION.

The President stated that Mr. White's query was, in his opinion, very suggestive, but he was disposed to think that it was hardly based upon a sufficiently broad view of the true state of affairs with respect to the genus under consideration.

The facts are that our native "Tortoiseshells" are representatives of a genus comprising about two dozen or more species ranging throughout Europe, Asia, and North and South America; or, in other words, throughout the greater portion of the Palearctic, Nearctic, Neotropical, and Oriental zoological regions. Now *V. Polychloros* and *V. Urtica* are two of a group of species more or less resembling them in colour and marking, this group being linked by a large number of intermediate forms with our *C-album* or "Comma" butterfly. He had thought the matter of sufficient interest to draw up the following list of species, showing the transition in question :—

<i>V. C-album</i>	Europe, N. and W. Asia.
<i>V. I-album</i>	Asia Minor, S. Europe.
<i>V. V-album</i>	Asia Minor, S. Europe.
<i>V. Californica</i>	California.
<i>V. Polychloros</i>	Europe, Asia.
<i>V. Xanthomelas</i>	E. Europe, N. India.
<i>V. Cashmirensis</i>	N. India.
<i>V. Urticæ</i>	Europe, W. Asia.
<i>V. Milberti</i>	S. America.

These were only a few of the more striking transitional forms selected for the purpose of illustrating the argument.

In the language of evolution we should therefore say that the genus *Vanessa* was in a very complete state of phyletic preservation, i. e., all the species having diverged from a common ancestor, the various steps in the process of divergence, instead of having become extinct and leaving large gaps between the species, as so frequently happens, have been more or less preserved down to the present time. *Polychloros*, *Xanthomelas*, *Urticæ*, &c., are thus true blood-relations, and, in accordance with the laws of heredity, it is not therefore surprising, although extremely interesting, that we should find one of these species occasionally giving rise to a variety resembling an allied form. If, therefore, Mr. White means to ask whether *Polychloros* is the progenitor of *Urticæ* on the strength of his having obtained a variety of the latter resembling the former, he (the President) would be inclined to answer that the two species under consideration, with their congeneric forms, had all descended from a common ancestor, and that the variety in question was a case of reversion to this ancestral type.

In illustration of the foregoing remarks the President exhibited specimens of *Urticæ* and *Polychloros*, with the intermediate North Indian *V. Cashmirensis*, and, as a parallel case, *Pyrameis Atalanta* and *Cardui*, with the intermediate *P. Callirhoë*, likewise from N. India.

[Mr. A. G. Butler, F.L.S., F.Z.S., of the Zoological Department, British Museum, has kindly furnished the Editor with the following valuable observations on the above:—

"I have read Mr. White's paper carefully through, and I must say that I perfectly agree with Mr. Meldola.

"The fact that the larva of *V. Polychloros* feeds upon elm, whereas that of *V. Urtica* feeds upon nettle, would naturally lead me to look for a mutual progenitor of these and the numerous allied species whose larvæ should feed indiscriminately upon either the tree or the weed; this we find in *V. C-album*; therefore it is more probable that the group to which the latter species belongs is the parent of both *V. Polychloros* and *V. Urtica* than that the latter should be derived from the former.

"The different races, or perhaps seasonal forms, of *V. C-album* show considerable modifications in the outline of the wing; and an examination of foreign species shows that these modifications may readily become permanent.

"I do not admit Mr. White's statement that food does not produce variation. I have very little doubt, if he will try the same experiment that I have done, his conviction will be seriously shaken. Some years since my friend, Mr. Herbert Goss, reared a number of singularly dark varieties of *Odonestis potatoria*, and the only explanation for this burst of melanism which he could suggest was, that he had been reckless as to the species of grass upon which he fed the larvæ. He subsequently sent me some larvæ, which I fed upon different grass every day, with the result that I did not rear a single typical example, all being melanic and much dwarfed. When I gave up collecting our British moths some years since I got rid of my specimens with the exception of a single pair, which are now in the general collection at the British Museum.

"Mr. White says that his *V. Urtica* is of the usual size, but with the characters of *Polychloros*; this description would answer very well for *V. Californica*, and, considering the great general resemblance between all the species of the group, the case is not a very remarkable instance of reversion.

"In a brood of about fifty *V. Urtica*, reared by me, there was a single very dark and small specimen which, although not like *V. Polychloros*, may have been a case of reversion to

something more nearly allied to *V. C-album*; and some of the species allied to the latter are very dark indeed.

"Lastly, as about half the species in the genus have the wings far more deeply dentated and subcaudate than the other half, whilst many gradations between the extremes of these two types exist, it seems most natural to look for the progenitor in a species which exhibits variation of form in accordance with the season, so that one may account for the prevalence of one type in one climate and of the other in another; and to regard two species of the same type as descended one from the other, especially when these two co-exist throughout Europe (or nearly so), seems to me to be a supposition in the highest degree improbable."]

II. THE EVOLUTION OF FRUITS.

By Professor G. S. BOULGER, F.L.S., F.G.S.

[Abstract of Discourse delivered *virâ voce*, February 26th, 1881.]

SYLLABUS.—The Descent Theory.—Definition of the word "Fruit."—Origin of fruits.—Marginal placentation.—Object of fruits.—Possible cause of the variability of the fruit.—Generalizations as to the course of variation in fruits.—Ontogeny of the fruit.—The phylogenetic importance of the fruit, and the results of the study of the fruit on the phylogenetic classification of flowering plants.

ONE of the strongest confirmations of the Descent Theory is its vital energy. It is not only consistent with hosts of ever-accumulating facts in every department of Biology, but it is constantly suggesting new lines of inquiry to which it forms the only key. Thus, though in tracing the evolution of the numerous kinds of fruit from the simplest and presumably earliest forms, it is necessary to assume this theory as a working hypothesis, not the least important result of the investigation will be the accumulation of much evidence that by its self-consistence tends strongly to show that the hypothesis truly represents the facts of Nature.

Affixing the definite meaning to the word "fruit" of "the whole of the *gynacium* which ripens in consequence of fertilisation, together with all surrounding accrescent or succulent parts, originating from a single flower,"—a definition free from many of the objections which attach to Sachs' use of the word for each apocarpous carpel,—we find nothing really analogous to a fruit among cryptogamic plants. The highest degree to which secondary sexual organs are developed in these groups only amounts to the formation of a seed. It is among the Gymnosperms that we have the nearest approach to the origin of the fruit.

Without concerning ourselves with the cognate but distinct

inquiry as to the morphological nature of ovules, we may perhaps safely assert that they are originally, normally, and almost universally developed from the margin of carpellary leaves. In *Cycas* such an origin is obvious, for we have a but slightly modified leaf, some lobes of which only are transformed into ovules. In the Juniper the three scales at the base of which the ovules are situated, becoming succulent, simulate the berry amongst true fruits. In abnormal Primroses the ovules are seen to spring from heel-like, auricular appendages at the base of the carpellary leaves, and all the evidence points to the origin of this order from a Caryophyllaceous ancestry, from which it differs only in having its petals united. The originally marginal character of the placentation of the *Caryophyllaceæ* is clearly seen, *e.g.*, in the carnations (*Dianthus*). The structure of those groups in which the placentation is still simpler, such as the *Polygonaceæ*, in which there is a single ovule rising from the base of the one-chambered ovary, may be best explained as reduction from the same marginal type.

The original fruit consisting then of a single carpellary leaf or of several, the ovules in either case being marginal structures, before tracing the general rules followed by Nature in the variations of fruits, it is necessary to consider the objects which fruits have to accomplish. The ultimate object of the fruit is subsidiary to that of the seed—the reproduction of the species. The immature seed requires protection from decay-producing excess of moisture or from the depredations of birds. The mature seed requires a non-conducting covering, that it may not be stimulated into premature germination by the deceptive warmth and moisture of autumn. Many plants producing offsets and many seeds necessarily falling near the parent plant, the species becomes a social one, like the grasses of our temperate regions, in which case the struggle for existence is more than usually severe, the relations of each individual to its surroundings—its hexicology—being similar to those of its neighbours, and in no way complementary to them. Accordingly dispersion is advantageous, especially to trees, beneath the shade of

which seedlings can hardly flourish. It is to secure the dispersion of the seed that fruits become attractive to birds.

In the insertion of foliar organs the spiral arrangement is far more general and in all probability earlier than the whorled: the multiplication of similar parts is a rudimentary character throughout organic nature, as exemplified in the somites of a centipede or the tail-vertebræ of *Archæopteryx*; every probability of comparative anatomy points to the earliest carpels as being as leaf-like as those of a pea, or of the bladder-senna (*Colutea*), and to the ovules as being several in number in each of the distinct carpellary ovarian chambers. In other words, we have as our primitive fruit a spiral of follicles, as in *Magnolia*.

That from such a starting-point such infinitely various forms should have resulted may perhaps be partly explained by the abundant supply of available nutriment determined towards the ovary by the act of impregnation, as towards a leaf or shoot by the virus of a gall-fly.

Reproductive structures being produced under influences diametrically opposed to those stimulating vegetative growth, there is a general tendency to truncation of the floral axis, the alternate phyllotaxis thus producing an arrangement of the floral organs in whorls of five or three—an arrangement soon inherited congenitally.

The crowding of the organs towards the centre of a flattened floral receptacle tends to reduce the number of carpels compared to that of the sepals, petals, and stamens; and similarly the crowding within the ovary tends to produce the abortion and reduction in the number of ovules. Nor is this mechanical result disadvantageous. It allows of the larger growth of the seed, *i. e.*, the accumulation of a more abundant food-supply, rendering the seedling longer independent of the atmosphere. Most small annuals, which are exposed to great risk of individual extermination, produce numerous small seeds; but, as large and highly-organised animals, such as the elephant, produce few offspring, so trees which exist longer individually do not require many seeds in

order to perpetuate their species. Thus we see such reduction both in the palms and in the oak.

As an elongated floral receptacle represents a lower type of structure than one horizontally expanded, and this again is earlier than the arrangement by which the ovary appears to be sunk in the receptacle, owing to an absence of separation for some distance between the axial and lateral structures, hypogynous insertion, as it is technically termed, probably preceded perigynous, and perigynous preceded epigynous.

The comparative anatomy of a group tells us far more as to the structure and evolution of fruits than we can learn from ontogeny, or the study of individual development. All foliar organs originate alike as a mere succulent, cellular papilla; and in vegetable ontogeny stages are so readily masked that whorled carpels seldom show any trace of primitively spiral arrangement, nor can we learn much from their early stages as to the true nature of ovules. Ontogeny is perhaps most useful in discriminating the origin of those layers of the pericarp which are known by the ambiguous terms, epicarp, mesocarp, and endocarp. Probably the carpels of the primitive fruit would so far retain their foliar character as to wither into a dry, parchment-like consistence, and burst by the consequent contraction. Cellular structures in this state are generally slightly hygroscopic, so that we have here the origin of many cases of violent dehiscence facilitating the dispersal of seed.

If, bearing in mind these general principles, we glance at the distribution of the different varieties of fruits through the natural orders, we are at once struck by the fact that the fruit-type is a character of high phylogenetic importance. The caryopsis of the grasses, the silicle of crucifers, the hesperidium of the orange tribe, the drupe and the pome in two sections of the *Rosaceæ*, the legume of the *Leguminosæ*, the cremocarp of the *Umbellifera*, the pepo of the gourd tribe, the cypsel of the *Compositæ*, and the nut of the *Cupulifera*, are familiar instances of this. It occurred to me, therefore, to review the natural orders from this stand-point, not disregarding other characters, but paying particular attention

to the fruit as a guide to their affinities. It is impossible here to do more than indicate my results, which have far exceeded my original hopes.

A very slight knowledge of plants convinces one of the great natural importance of the distinction, first pointed out by the botanical glory of Essex, John Ray, between Monocotyledons and Dicotyledons. Adopting this primary division, and considering Mr. Bentham's *Nudifloræ* as the lowest among Monocotyledons, we find that we have many monocarpellary fruits in very rudimentary flower-types, followed by a ring of apocarpous follicles, generally six in number, in the flowering-rush (*Butomus*), and by a spiral of more numerous ones in the water-plantain (*Alisma*); but that syncarpy is early originated (even in the *Lemnaceæ*), the fruit becoming capsular, and that succulence also originates early (in the *Araceæ*). We constantly find in tracing the evolution of fruits that Nature arrives at the same result, such as the capsule or nuculane, by various routes; hence the practical uselessness of an artificial grouping of fruits.

Among Mr. Bentham's *Coronariæ* a syncarpous fruit of three carpels asserts itself as the typical monocotyledonous fruit; succulence re-appears, as in *Asparagus* and *Ruscus*; and we get the previously-mentioned reduction in the coconut and date, accompanied in the former with that development of woody texture in the pericarp, which proves an effectual protection against the action of sea-water, if not against crabs or monkeys.

The *Glumifloræ* I consider merely as reduced from the last-mentioned type, their one-seeded caryopsis illustrating a general principle which should have been before stated, that when numerous small flowers form a crowded inflorescence (as also in *Compositæ* and *Umbellifera*) we have a reduction in the number of carpels answering to a reduced need of them.

Among Dicotyledons my examination led me to recognise four great groups, for which I select the names *Thalamifloræ*, *Discifloræ*, *Peryginæ*, and *Bicarpellatæ*. Of these the second seems undoubtedly a branch-phylum from the first, and the fourth probably from the third. Among the *Thalamifloræ*

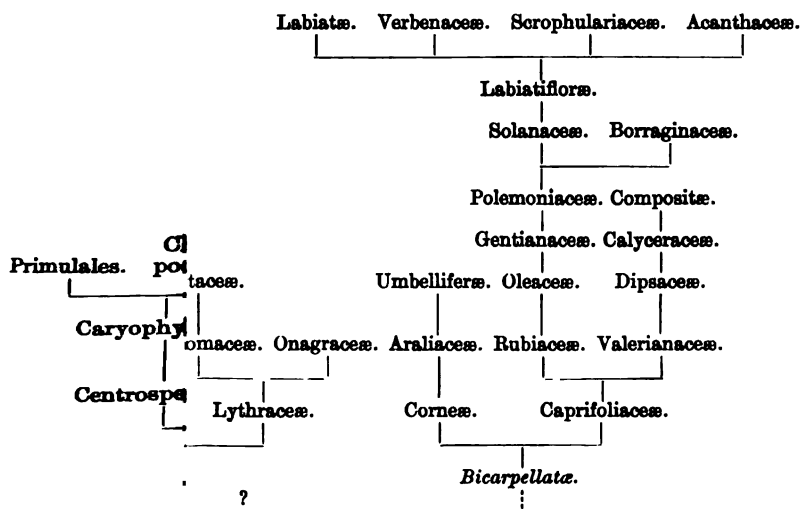
the various apocarpous fruits, first spiral and then whorled, of the Ranales, of which the Laurales are probably reduced types, lead through the fruits of the water-lilies (*Nymphaea*) and of *Sarracenia* to that of the poppy (*Papaver*); and in the same tribe we have reversion to apocarpy in *Platystemon* and a transition to the siliqua in *Glaucium* and *Chelidonium*. Among *Cruciferae* the genus *Tetrapoma* (an illustration of the fact, well known to biologists, that exceptional forms teach us more than those which are regular or typical) indicates the close affinity to the other *Parietales*, the capsules of *Resedaceae*, *Violaceae*, &c.; and we have here probably a great "centre of divergence" leading to the *Disciflorae*, *Guttiferales*, *Malvales*, and *Centrospermae*. Of the latter mention has been made already; among the *Malvales* I can only now refer to the succulent *Malvaviscus* and the sand-box tree (*Hura crepitans*) which indicates that relationship between the *Malvaceae* and *Euphorbiaceae* which is paralleled by that between *Tiliaceae* and *Urticaceae*; among the *Guttiferales* the capsule with central placentation leads from *Camelliaceae* to *Ericaceae*; and among *Disciflorae* the superior schizocarp with a central gynophore in *Geranium* leads to the fruit of *Tropaeolum* and the stipitate capsule in the *Rutaceae*, which, being sometimes fleshy, passes to the "hesperidia" of the orange tribe, whilst the Celastrales, with the varying "nuculanes" of the holly, *Euonymus*, Buckthorn, and Vine, lead to the still more variable fruits of the Sapindales, which range from the horse-chestnut and Litchi to the winged "samara" of maple and sycamore.

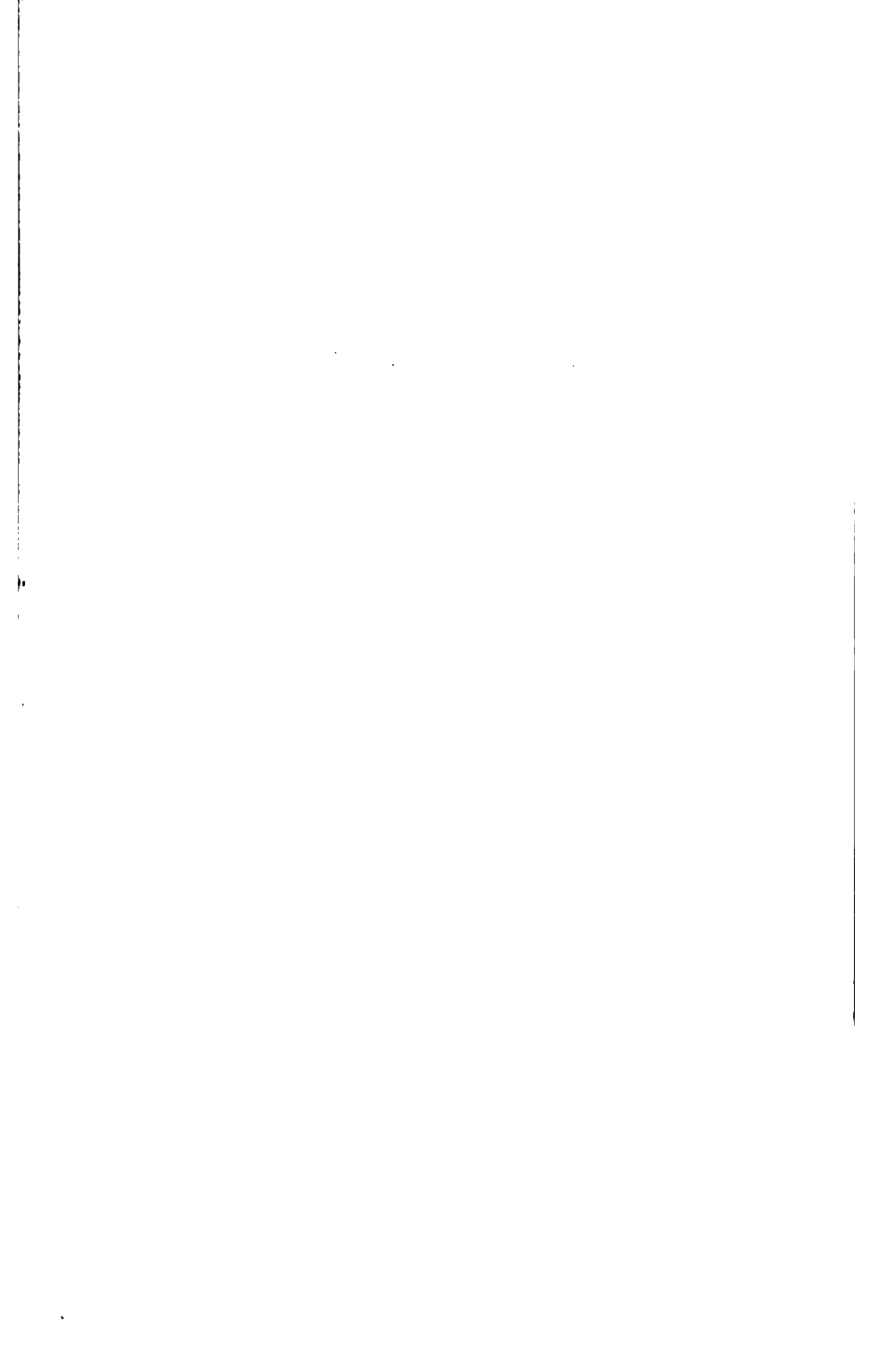
The *Perigynae*, commencing with the numerous related fruit-types of *Rosaceae*, among which the "etærio" of achenes in *Potentilla* perhaps represents the primitive type, lead through the *Drupaceae* to the legume, perhaps through *Pomeae* to the nut of the *Cupuliferae*, and through *Spiraea* to the Saxifragae. Here we get a semi-inferior fruit with the carpels reduced in number, near which the branch-phylum of the *Bicarpellatae* (well represented by the Umbellales) may have been given off; whilst it has certainly been a centre of divergence leading through *Hillebrandia* to the *Begoniaceae*

and the gourds, through the berries of *Ribes* to the *Cacti* and through *Lythraceæ* to *Melastomaceæ* and *Myrtaceæ*, which latter order includes the pomegranate and the Brazil-nut.

The *Bicarpellatæ* only have more than two carpels in the case of the three primitive orders, *Cornaceæ*, *Araliaceæ*, and *Caprifoliaceæ*; but in these cases the fruit is as essentially a cremocarp as in the *Umbelliferaæ*. This is reduced in the *Valerianaceæ* to the cypsele of the *Dipsaceæ*, *Calyceraceæ*, and *Compositæ*, which, though one-chambered and one-seeded, is essentially bi-carpellate, as is also the olive, the fruits of the *Gentianaceæ*, the "caroerule" of the *Borraginaceæ*, and *Labiataæ*; and the varying capsules and "nuculanes" of *Scrophulariaceæ* and *Solanaceæ*.

These affinities are shown by the tentative pedigrees, which are shown in the accompanying table.





III. THE BLACKWATER VALLEY, ESSEX.

By W. H. DALTON, F.G.S., of H.M. Geological Survey.

[Read March 26th, 1881.]

PLATE I.

THE lower part of the valley of the Blackwater offers some marked peculiarities of geological, and therefore geographical, structure, and it has occurred to me that a sketch of it might form a useful illustration of some general principles of those sciences.

From the range of the Chalk hills overlooking Royston the surface of the country slopes gently to the south-east as far as Witham and Chelmsford, and then rises in the bold ridge of Tiptree Heath and Danbury, separated by the estuary of the Blackwater.

Part of this area is drained northward by the Cam, which has cut its way back through the escarpment of the Chalk at Saffron Walden; the western part is drained by the Lea, and the north-east by the Stour and the Colne, whilst the central part, extending from Dunmow to Coggeshall, may be termed the Blackwater Basin, though the rivers traversing it bear the names of Cann, Chelmer, Ter, and Guith, the easternmost stream only being termed Blackwater. The course of all these is, roughly speaking, south-eastward, down the general slope, into which they cut more or less deeply. On reaching the ridge mentioned above, they flow along its foot from either end, successively combining with each other, and passing into the estuary near the middle. I need not enter into the subordinate deviations of these rivers from their general course, but may remark, in passing, that the upper part of the Blackwater proper, called the Pant, is in the direct line of the Guith from Shalford to Bocking, and then passes by a more easterly course to Coggeshall and Kelvedon.

The broad gentle slope traversed by these rivers consists of Boulder Clay, at the surface, from ten to eighty feet thick, underlaid by sand and gravel, rarely more than thirty feet thick, and sometimes altogether absent, and this by the London Clay, the limits of which are near a line through Thaxted and Bishop Stortford. To the north-west of this line is a narrow belt of the Lower London Tertiaries, followed by the Chalk, the Boulder Clay and subjacent gravels generally concealing these older beds. On the flanks of the Ter Valley occur patches of clean brick-earth overlying the Boulder Clay, but possibly constituting only the upper part of that formation, and not separated from the remainder by any important interval.

Between Witham and Feering the Boulder Clay, which previously only formed the plateau between the Guith and Blackwater, descends suddenly into the valley, not only cutting off the gravels that originally lay below it, but passing below the general surface of the London Clay, as shown in the valley bottoms at Coggeshall, Faulkourn, &c. The Boulder Clay only rises a short distance up the flank of the Tiptree ridge, the sides and crest of which are coated with a considerable depth of sand and gravel.

A part of Tiptree Heath having been fixed upon as a good site for the second County Asylum, an artesian well was resolved upon as the only satisfactory source of water supply. Calculation from the nearest of previous wells showed that there was some local disturbance. The Chalk surface descends from Braintree to Witham at the rate of 21·23 feet per mile, giving depth at Asylum of 495 feet, whilst it rises from Maldon and Heybridge at 74 feet per mile, giving depth at Asylum of 194 feet.

Three possibilities presented themselves :—

1. There might be a gentle roll over of the beds.
2. There might be a powerful undulation or reversal of the beds.
8. There might be a fault throwing down the beds to the north.

The boring proved the last two of these contingencies to be combined.

The base of the London Clay was met with at 295 feet, in the shaft, with a westerly dip of 18 in 68. Boring soon afterward commenced in the Reading Beds, and at 848 feet a fault was passed, and the *London Clay reappeared*. Its base was again reached at 888, the Thanet Sands at 422, and the Chalk at 477 feet. The Reading and Thanet Beds must be inclined at high and varying angles, as at Witham (only two miles off) they are only 27 and 24 feet thick respectively.

We have here, therefore, a great wave, broken along the crest, of the earth's crust, and, in a way that is most unusual, determining approximately the form of the surface. In hard rocks such a structure would most likely be along a valley, with beds dipping into the hill on both sides. Even if a stream had commenced a channel vertically over the present course of the Blackwater, landslips would have perpetually occurred from the south-east bank, till the stream was shifted to the centre of the geological ridge.

But in this case the surface consists chiefly of gravel, without any bedding to produce landslips, and the underlying clay is a homogeneous mass, more prone to slipping along its joint faces than the slightly-marked bedding-planes, so that internal structure does not much affect the physical features.

But the coincidence of a very marked ridge with an exceptional undulation of the beds is suggestive of cause and effect, and the draping of the hill with Glacial gravels, usually only present at lower levels, and the absence from the crest of any trace of Boulder Clay, which mantles round the foot of the ridge to the N.E., seem to point to an elevation *during the Glacial period*, whereby the crest of the ridge was raised above the berg-covered sea, and a current produced at its foot, which scoured away the gravel and dug into the London Clay, leaving a channel to be afterwards occupied by the Boulder Clay.

On the subsequent emergence of the entire country, the slope of the clay-bed determined the general trend of the streams down to the N.W. foot of the ridge, and during the cutting through of the estuary a lake was formed by the

accumulated waters. The gravel brought down into this lake by the Guith and Blackwater forms a continuous terrace from Witham to Braintree, interbedded with shell-marl, swamp-mud, and brick-earth, as described in the Geological Survey Memoir on Sheet 47.¹ The elevation continued till the deep channels of the Essex estuaries were formed, when subsidence took place, readmitting the sea as far as Colchester, Maldon, and Battle Bridge. I have elsewhere published reasons for believing that a slight subsidence is now in progress.²

Those who care to investigate the origin of the undulation described above may be interested in hearing that a parallel undulation has been noticed in the Chalk ridge above Royston, with an outward north-westerly dip of 60°, and that the prolongation of the line of Tiptree Heath coincides, near Deptford, with a fault bringing up the Chalk through the Tertiaries, and, in the opposite direction, we have Chalk coming to the surface in an abnormal way, at Shelly (near Hadleigh) and at Ipswich, whilst farther away in Suffolk other points of disturbance have been noticed along a line nearly coincident with the Yarmouth branch of the Great Eastern Railway.

I must defer to another occasion my reasons for supposing that the undulations are confined to the upper 1000 feet of the earth's surface, and are due to lateral pressure in the Chalk, and that the subjacent Coal-Measures or other rocks are not affected thereby.

Whitaker, W., W. H. Penning, W. H. Dalton, and F. J. Bennett. 'The Geology of the N.W. Part of Essex and the N.E. Part of Herts., with Parts of Cambridgeshire and Suffolk.'—*Geological Survey Memoir*. 8vo. London. Pp. vi., 92; 19 woodcuts. Price 3s. 6d.

² 'Subsidence in East Essex.'—*Geol. Mag.*, dec. ii., vol. iii., pp. 491—498. (1876).

IV. THE DEVELOPMENTAL CHARACTERS OF THE LARVÆ OF THE NOCTUÆ AS DETERMINING THE POSITION OF THAT GROUP.

By RAPHAEL MELDOLA, F.C.S., V.P.E.S., &c.

[Read March 26th, 1881.]

I AM induced to bring a few remarks on the above subject under the notice of the Club, because we have among us a large number of Lepidopterists to whom these observations may be of use, from the twofold point of view of suggesting a fruitful line of work for those who are in the habit of larva breeding, and, on the other hand, as having some bearing on the actual cabinet arrangement at present adopted by many of our collectors.

Among the many classes of biological facts that have received an explanation by the publication of Darwin's 'Origin of Species,' the phenomena of embryology, or the development of the individual organism from the germ to a state of maturity, are of the highest importance as revealing in many cases the history and true affinities of groups of species. In the course of its development an animal passes through stages which successively represent, with more or less completeness, the stages through which the species has passed in arriving at its present condition. The development of the individual is in this sense spoken of as the "ontogeny," and the development of the race is known as the "phylogeny." In accordance with the Darwinian theory all the species of one group, such as a genus, have descended from a common ancestor, so that all the species of such a group would be expected to approach each other more closely in their characters at certain stages of their ontogeny than when adult, or, as Haeckel has expressed it, the ontogeny recapitulates the phylogeny with more or less falsification, owing to the necessary abbreviation of the successive stages. By comparing the ontogeny of allied species and groups of

species, we thus arrive at a more certain indication of the true affinities, *i. e.*, the blood relationships, than by comparing adult individuals only.

In order to show the application of these principles, I may perhaps be permitted to give a hypothetical case. Suppose, for example, that the foals of the horse were frequently or invariably striped when young, but lost their stripes as they grew towards maturity. We should be justified on this ground alone in believing, with a great amount of probability, that the horse had descended from a striped ancestor, and if the foals of an allied species, such as the ass, were also striped when young, this probability would be greatly increased. If, on extending our comparisons, we found that other allied species, such as the zebra, were striped throughout their lives, we should conclude, in accordance with the principles of the descent theory, that the horse and ass were derived with the zebra from a common ancestor having the characters of the latter species, and since the horse and ass have, so to speak, outgrown the striped stage of their existence, which, on our supposition, is retained only during a short period of their younger stages of growth, we should say that these species were further advanced in development *i. e.*, were *phyletically younger* than the zebra.

From the above considerations, it will be seen that the ontogenetic development may thus throw much light on the past history of a species or group, and through this on the true systematic affinities. I may now pass on to our immediate subject.

The two systems of classification now made use of by our Lepidopterists are those adopted in Stainton's 'Manual of Butterflies and Moths' (1857), and by Doubleday in his 'Synonymic List' (1866). In the former, the Noctuidæ are placed between the Bombycinæ and the Geometrinæ; in the latter, the Geometræ follow the Nocturni (Sphingæ and Bombyces of Linnæus), and are in their turn followed by the Noctuæ, with which they are connected by the Drepanulæ and Pseudo-Bombyces. It is here quite unnecessary to enter into the histories of these two systems of classification.

I propose to deal only with the question as to the affinities of the Geometræ and Noctuæ, since, in the case of these two groups, materials have been accumulating for some years, which, in my opinion, enable us to give a definitive answer to the question of their relative positions.

Before entering into details, I may just call attention to the differences in structure between the caterpillars of the Noctuæ and of the Geometræ.

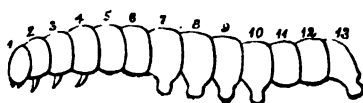


Fig 1

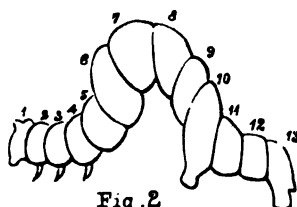


Fig. 2

A perfect Lepidopterous caterpillar is composed of thirteen segments, counting the head as the first, and possesses altogether sixteen legs, the three foremost pairs being the true or thoracic legs, which correspond with the legs of the perfect insect. The thoracic legs are horny, and are situated on the 2nd, 3rd, and 4th segments. The other legs, which are fleshy, are known as the abdominal legs, prolegs, or claspers, and are situated on the 7th, 8th, 9th, 10th, and 13th segments. The larvæ of the butterflies, Sphinges and Bombyces, have the full number of legs; the caterpillars of the Geometræ, on the other hand, have, as a rule, only four claspers, one pair on the 10th and 13th segments, so that in walking they arch their backs in the peculiar manner so familiar to us, and which has given rise to the name of "geometer" or "looper." Some few exceptions occur among the Geometræ, such as *Rumia Cratægata* and *Odontopera*

bidentata, which have eight claspers, and *Metrocampa margaritata* and *Ellopia fasciaria*, which have only six; and I would suggest that the ontogenetic development of these species should be studied carefully, with special reference to the number, relative lengths, and positions of the abdominal legs. The Drepanulidæ and Pseudo-Bombyces have in most cases the full number of legs, but the last pair (18th segment) is sometimes absent, or replaced by forked appendages. The majority of the Noctuæ larvæ have sixteen legs, but as we approach the end of the group this number becomes variable, as will be seen from the following list compiled from Stainton's 'Manual':—

TRIFIDÆ.

BOMBYCIFORMES.—Larva with 16 legs.

GENUINÆ.—Larva with 16 legs.

MINORES.—Larva with 10, 14, or 16 legs.

QUADRIFIDÆ.

VARIEGATÆ.—Larva with 12, 14, or 16 legs.

INTRUSÆ.—Larva with 16 legs.

LIMBATÆ.—Larva with 16 legs, "but looping the anterior segments when walking."

SERPENTINÆ.—Larva with 12 or 14 legs.

This fact becomes still more evident, if we make a more detailed analysis of the latter groups:—

MINORES.

ACONTIDÆ.

Agrophila.—Larva geometriform, with only 12 legs.

Acontia.—Larva geometriform, with only 12 legs.
(The larva of *A. luctuosa* is exceptional, having 16 legs).

ERASTRIDÆ.—Larva with 14 legs, half-loopers; 1st pair of claspers indistinct.

Erastria.—Larva with only 8 pairs of claspers.

Bankia.—Larva with 2 pairs of claspers, 3rd pair rudimentary.

ANTHOPHILIDÆ.—Larva with 12 or 14 legs.

PHALENOIDÆ.—Larva with 16 legs, but two 1st pair of claspers rudimentary.

VARIEGATÆ.

PLUSIDÆ.—Larva with 12 or 16 legs, half-loopers.

Abrostola.—Larva with 16 legs, 1st pair of claspers rudimentary.

Plusia.—Larva with 12 legs, other two pairs completely absent.

GONOPTERIDÆ.—Larva with 16 legs.

INTRUSÆ.—See previous list.

LIMBATÆ.—See previous list.

SERPENTINÆ.

OPHIUSIDÆ (Genus *Ophiodes*).—Larva with 16 legs, the two 1st pairs of claspers somewhat shorter than the others.

EUCLIDIIDÆ (Genus *Euclidia*).—Larva with 12 legs.

POAPHILIDÆ.—(*Phytometra Anea*, larva a semi-looper).

On this evidence alone—supposing for the moment that larval characters were adopted as the basis of our classification—we should be justified in regarding these latter groups of the Noctuæ as most closely allied to the Geometræ, and this conclusion is fully borne out by the perfect insects, since it is among these groups that we find the most Geometriform Noctuæ, such as *Brephos*, *Euclidia*, and *Phytometra*.¹ More than forty years ago Professor Westwood insisted upon the perfectly natural transition from the Noctuæ to the Geometræ, “so beautifully effected by *Catocala*, *Plusia*, and other half-loopers, as their larvæ are termed, and *Ophiusa*, *Frastria*, &c.” (‘Introduction to the Classification of Insects,’ vol. ii., p. 868.)

In order to avoid lengthy repetitions, I will in future speak of the groups *Bombyciformes* and *Genuina* as “Bombyciform Noctuæ,” and of the *Minores*, *Variegata*, *Intrusa*, *Limbatæ*, and *Serpentina* as “Geometriform Noctuæ.” It is obvious that the relationship of the latter to the Geometræ is accurately expressed by the arrangement in Stainton’s ‘Manual,’ whilst that adopted by Doubleday in the

¹ The American genus *Drasteria*, allied to *Euclidia*, and the American family *Focillidæ* are also very geometriform in their imaginal characters.

'Synonymic List,' and by Newman in his 'British Moths,' appears to be most unnatural.

It has often been asserted by Lepidopterists that no true systematic arrangement can be founded on larval characters alone, and this remark is to some extent correct, if we limit our comparisons to the *adult caterpillars* only, so that objections might perhaps be legitimately raised from this point of view to the suggested restoration of the older arrangement. But the case is quite different if, instead of comparing the adult larvæ, we study their comparative ontogeny. By this means, as explained in the previous part of this paper, we may gain an insight into the true relationships of the species. The first application of this principle to Lepidopterous larvæ was made by Professor Weismann, of Freiburg, in his 'Studien zur Descendenz-Theorie' (vol. ii., 1876), in which work the author has studied the markings of the larvæ of the *Sphingidæ* in great detail from this point of view. The whole subject is as yet almost in its infancy, and one of my chief objects in bringing this paper before your notice is to endeavour to convince you of the great necessity for paying attention to the earlier stages of caterpillars. No group of butterflies or moths has as yet been completely worked out in the manner in which Weismann has investigated the *Sphingidæ*, and till this is done for the whole order we shall never arrive at a truly natural classification. By making careful drawings of caterpillars at every stage of growth—using the microscope in the case of the youngest stages—all who are given to larva breeding may contribute substantially to the more scientific portions of our studies.²

I shall now adduce evidence to show that the larvæ of most of the Bombyciform Noctuxæ are geometriform when young; the Geometriform Noctuxæ are, as will be remembered, generally semi-loopers throughout life.

Among the earliest observations in this country is a note by Dr. Buchanan White (Ent. Mo. Mag., vol. v., 1869,

² The genus *Acronycta* specially claims to be thus worked out. See A. G. Butler in Trans. Ent. Soc., 1879, p. 313.

p. 204), in which he calls attention to the fact that the newly hatched larvæ of *Calocampa exoleta* possesses only three pairs of claspers. This was followed by a note by our member, Mr. Bernard Lockyer, who states that "most, if not all, of the larvæ of the Noctuæ belonging to the section *Genuinæ* have, when first hatched, but three pairs of claspers, the first two pairs being quite undeveloped; they are gradually developed as the larvæ increase in size, and by the third moult they are as large as the other pairs, and fit to be used in walking. Consequently, when first hatched, the larvæ are semi-geometriform, and loop more or less when in motion." ('Entomologist,' vol. v., 1871, p. 433). Mr. Lockyer gives the following list of species, which he had bred from the egg:—*Leucaniidæ*, *L. lithargyria*; *Apameidæ*, *M. Brassicæ* and *persicariæ*; *Caradrinidæ*, *G. trilinea*; *Noctuidæ*, *R. tenebrosa*, *N. festiva* and *brunnea*; *Orthosiidæ*, *T. gothica*; *Hadenidæ*, *E. lucipara*, *H. serena*, *A. nebulosa*, and *H. Chenopodii*; *Xylinidæ*, *X. lithorhiza*.³ Among the *Heliothidæ*, *H. dipsaceus* appears to be an exception, the larvæ never possessing less than the usual number of claspers.⁴

The next observation to which I propose to direct attention is contained in a note published last year by Mr. Stainton (Ent. Mo. Mag., vol. xvii., 1880, p. 185), and referring to the young larvæ of *Triphæna pronuba*. Having received a batch of eggs for determination, Mr. Stainton observed that the young larvæ were half-loopers, and concluded that they were those of *Plusia gamma*. He was informed by his correspondent, however, that the eggs were those of *T. pronuba*, and, in order to have this view confirmed, he forwarded a batch of similar eggs to the well-known larvæ breeder, Mr. W. Buckler, of Emsworth, who reported that the larvæ were undoubtedly *T. pronuba*, and added some descriptive notes,

³ Of this last species, Mr. Lockyer states that the larvæ "is especially geometriform when young, and has the habit of resting attached only by its claspers, with its body held straight out from the surface on which it is resting, after the manner of true Geometræ."

⁴ This exception may be only apparent; in such doubtful cases it is advisable to extract the embryonic larvæ before it actually leaves the egg.

from which I take the following extracts:—In the newly hatched larva “the first two pairs of ventral legs are at first not in use, and but little developed, and the larva often rests in a looping position, and walks like a semi-looper.” After the first moult they still looped in walking, the less developed first two pairs of claspers not being used. The Geometer-like habit appears to be abandoned in the fourth stage, *i. e.*, at the third moult. Mr. Buckler, who is perhaps one of the most skilled and experienced larva breeders in this country, adds further, that the larvæ of *Taniocampa opima* are semi-loopers when young, and so also are those of *Phlogophora meticulosa*.

The next observation is of great importance as showing that a species which is a semi-looper when adult is more perfectly geometriform when young. In a recently published description of the caterpillar of *Euclidia glyphica*, Mr. G. T. Porritt remarks that the newly emerged larva “when walking arches its back like that of a Geometer.” (*Ent. Mo. Mag.*, vol. xvii., 1881, p. 210). When from an inch to an inch and a quarter in length they had lost the true looper style of walking, but were still half-loopers, having no claspers on segments 7, 8, 11, and 12. The above-mentioned note by Mr. Stainton has called forth some remarks in the current number of the ‘*Entomologist's Monthly Magazine*’ (vol. xvii., p. 287), by Mr. R. F. Logan, who states that, according to his experience, nearly all the larvæ of the *Trifidæ* are semi-loopers when first hatched. “The *Cymatophoridæ* are an exception, but they are altogether abnormal, and somewhat allied to the Tortricina, the eggs being pear-shaped, and the larvæ living between united leaves and moulting only four times, while the normal number of moults in the *Trifidæ* is five.”

Turning now from native to American observers, I was fortunate enough to discover some corroborative evidence in Mr. C. V. Riley's Reports ‘On the noxious, beneficial, and other Insects of the State of Missouri.’ The following notes are taken from this author:—

Agrotis inermis, Harris. Newly hatched larvæ have “the

peculiarity of looping up the back when in motion;" this habit is lost after the first moult. (First Annual Report, 1869, pp. 78, 74.)

Leucania unipuncta, Haworth (the "army worm," = *L. extranea*, Guenée). Newly hatched larva has "two front pair of prolegs atrophied, so as to necessitate looping in motion." Still geometriform in second stage. In third stage looping habit lost, "but the front prolegs are still somewhat the smallest." In the fourth stage the claspers are of nearly equal size, and in the sixth stage the front claspers are said to be, if anything, longer than the hind ones. (Eighth Annual Report, 1876, pp. 184, 185.)

Leucania albilinea, Guenée. Newly hatched larva "quite a looper, the prolegs or joints 6 and 7 being still more atrophied, and those on joint 8 being short." Looping habit lost in second stage. (Ninth Annual Report, 1877, pp. 58 and 56.)

All these facts point to the conclusion that the Noctuæ have been derived from geometriform ancestors, so that this group is phyletically younger, *i. e.*, has made a further advance in the development than the Geometræ. The geometriform sections of the Noctuæ are thus the more closely related to the Geometræ, and, as already insisted upon by Mr. Lockyer in the note referred to,* should therefore follow this last group, as in Stainton's list. The higher groups of Bombyciform Noctuæ (*Thyatira*) approach the Pseudo-Bombyces in the attitude assumed by the larva when at rest, as well as in the characters of the imago. If, therefore, the *Psychidæ* be referred to the Tineina, the following arrangement appears to me to best represent the existing state of our knowledge, although, of course, further investigations of larval ontogeny may lead to other modifications:—

* The author does not consider the head as the first segment, so that segments 6, 7, and 8 correspond with segments 7, 8, and 9 of English entomologists.

* Mr. Lockyer draws the conclusion that the Geometræ are "*undeveloped Noctua*," an expression which appears to me misleading, as it implies that the existing Geometræ are in course of transformation into Noctuæ.

Bombycidae. (Including *Endromidæ* and
DREPANULIDÆ. *Saturniidæ*.)

PSEUDO-BOMBYCES.

NOCTUÆ.

TRIFIDÆ.

QUADRIFIDÆ.

GEOMETRÆ.

DELTOIDES.

&c.

The *Cochliopodidæ* appear to be most naturally placed between the *Hepialidæ* and *Nolidæ*. The natural affinities of the *Ægeriidæ* have been discussed by Mr. A. G. Butler (see Trans. Ent. Soc., 1878, p. 121), who comes to the conclusion that their true position is "after the *Pyrales*, and before the *Gelechiidæ*." The affinities of the *Cymatophoridæ* with the Tortrices may have to be expressed by the removal of this family from its present position, but more evidence on this head is required. Mr. Butler's proposed distribution of the species hitherto referred to the genus *Acronycta* among the *Arctiidæ*, *Liparidæ*, *Notodontidæ*, and *Noctuæ*, will be found in the paper referred to in Note 2.

The remarks which I have offered in this paper will, I hope, secure the restoration of the older method of arrangement in our cabinets, and at the same time lead to further work in the promising field of the comparative ontogeny of larvæ.

V. STONE IMPLEMENTS FROM THE NEIGHBOURHOOD OF
CHELMSFORD, ESSEX.

By HENRY CORDER.

[Read April 30th, 1881.]

PLATE II.

ABOUT three years since a man who was formerly in our employ brought to me a very fine specimen of a Neolithic spear-head, dagger, or knife, measuring six and a half inches long by two and a half inches wide. It is very thin, and beautifully chipped, but not polished. Near one end are notches, three on one side and two on the other, apparently to serve as catches when binding the celt to the shaft or handle.

The specimen came from a gravel pit near the "Admiral's Park," Chelmsford; and the workman asserts that while standing at the bottom of the pit, and working at the gravel with a pole, he disengaged it from a seam of larger stones about twelve feet from the surface. The soil above is not very thick, so that there would be many feet of gravel above the implement. The celt has no signs of wear or of gravel stains upon it, and I am told that it could not have come from undisturbed gravel. In support of the one theory, I have the man's own statement that he poked it out himself from the stones which he considered to be undisturbed. This would be a seam probably almost free from the red ferruginous colour and adhesive qualities of ordinary gravel. At the spot in question the stratum is evidently, I think, valley gravel from the River Cann, about 200 yards from the bank, and perhaps thirty feet above the water level. In support of the other view, viz., that the soil was not undisturbed, we have the assertion of a former owner of the pit that a quantity of bones of animals, and, I think, stags'

horns were found near by in the soil, tending to show that the ground might have been disturbed; and we have also to take into consideration the possibility of the man having made a mistake in determining the spot from whence the implement fell.

[As Mr. Corder's celt is a very beautiful example of a type by no means common, a figure is given of it, showing the front and side views. The specimen has been seen by Major-General Pitt-Rivers and by Mr. Worthington Smith.—Ed.]

I also exhibit a hammer-head made of an oval mass of sandstone, such as abound in our Glacial deposits. It is five inches long by three and a half wide, and has a hole apparently bored from both sides, as it slopes, crater-wise, from both surfaces to the middle. The ends of the stone give evidences of use, showing numerous slight chippings and irregularities. It was found in a yard at Writtle, Essex, having apparently been brought there from the fields with other stones for paving purposes.

The third small flint I exhibit was found near Chignal, Essex, by Mr. R. M. Christy, a member of the Club. It is three inches long and three-fourths of an inch wide. One side is polished, the other roughly chipped, and the stone tapers towards each end. The use to which it could have been put I do not know, but perhaps it may have been used as a *polishing* implement in dressing other stones.

VI. NOTE ON SOME ANCIENT BRONZE IMPLEMENTS ("SOCKETED CELTS") FROM THE NEIGHBOURHOOD OF LITTLE BADDOW, ESSEX.

By HENRY CORDER.

[Read April 30th, 1881.]

ABOUT two years ago a man who was land-ditching at Little Baddow, near Chelmsford, on a farm belonging to Andrew Marriage, Esq., dug out a number of fragments of bronze at a depth of about two feet from the surface. There are in all twelve pieces, of which the following is a list:—

No. 1. A celt 4 inches in length, quite perfect. On the flat sides are five raised ribs ending in knobs.

Nos. 2 and 3. Celts $8\frac{1}{2}$ and $8\frac{1}{2}$ inches in length, unornamented. These also are perfect.

No. 4. A celt rather broken, about 8 inches long, ornamented round the socket with lines and zigzag work.

Nos. 5, 6, 7, and 8. Fragments of celts. One is tolerably perfect, with raised lines as in No. 1. Another appears to have had a double cavity inside.

No. 9. Portion of a blade. One side is sharpened, the other grooved with lines.

Nos. 10, 11, and 12. Lumps of unwrought metal. One which has been cut shows a red colour like copper.

The whole of these were found close together, and appeared to have been originally enclosed in some vessel which had decayed. It is interesting to notice that there are no two of them alike; the size or the ornamentation varies in every case.

VII. THE FIRST NIGHT'S "SUGARING" IN ENGLAND.—A
REMINISCENCE OF EPPING FOREST IN 1848.

By JAMES ENGLISH.

[Read April 30th, 1881.]

IN drawing up this little sketch of my first night's "sugaring" for attracting moths, I wish to state that I do not claim for myself any merit as the discoverer of this mode of collecting insects. The late Henry Doubleday, of Epping, had observed the fact that moths were attracted to empty sugar hogsheads that had been turned out of the warehouse. I had also noticed the same circumstance. The moths (which were usually of the most common species) came only in small numbers, and chiefly during the autumnal and rainy seasons; in the summer months the *Bees* in one fine day would clear out every vestige of sugar remaining in the casks. Although this fact was known to Henry Doubleday, the idea was never utilised by him for the capture of insects apart from the hogsheads. It was certainly myself who first applied "sugar" practically as a valuable adjunct to the net and lanthorn in the search for *Lepidoptera*. This experiment was made in the summer of 1848. Henry Doubleday was on his tour in France at the time. Previous to that year the only means used to capture *Noctua* was by the use of the old-fashioned clap-net, at the forest-side, hedgerow, or flowery meadow, where our little fluffy friends winged their way like fairy sprites as the evening softly fell, and the twilight deepened into night. But to net them was a difficult task, and our captures were often very meagre. Besides which the condition of the specimens was by no means good, and often before we could get them safely out of our gigantic nets the delicate beauty of the insects had vanished, the loosely attached scales being rubbed off against the rough lino. We had then no "cyanide bottles" to lull them gently into

sleep. The only fine and presentable specimens of the great *Noctua* tribes then shown in cabinets were obtained by breeding the insects from the caterpillars or pupæ, or by searching for the perfect moths on palings or trunks of trees. But the bulk of the *Noctua* in collections were miserable objects, and even the best cabinets exhibited frequent blanks. The discovery of the method of sugaring changed all that.

During the period already alluded to, the summer of 1848, *Noctua* were very abundant: much more so, I think, than they have been during late years. One fine evening I was walking about my garden, net in hand, when I noticed a number of *Noctua* flying over and settling upon a plum tree. I was soon busy at work, and at the close of the evening thought I had made up a good box; but of course the majority of the moths were in the usual plight, with thorax rubbed and wings abraded. I asked myself what was the cause of such numbers of *Noctua* congregating at that particular tree; no other tree in the garden was so patronised. On examining the plum tree the next morning, I was soon satisfied that the moths were attracted by the "honey-dew" with which the leaves were covered. The idea quickly occurred to me that sugar dissolved in water might be brushed on the leaves, so as to make a kind of artificial "honey-dew," which possibly would prove a good bait for our furry friends. As the evening approached I became eager to carry out my experiment. I brushed nearly all the leaves of the plum tree with sugar and water, and awaited the result. A more anxious time I never experienced in my entomological career. As the shades of evening crept on, *Noctua* after *Noctua* came in constantly increasing numbers, till the air around the plum tree seemed alive with moths, all soon settling on the leaves, and, to my great surprise, many cared not to fly away or even move.

I now brought my lamp, and, turning the light upon the tree, I beheld a scene such as I had never before witnessed except at sallow blossoms in spring, and the analogy held only in numbers, not in the variety of species which then gladdened my eyes. There were, of course, the usual garden

occupants, but amongst them were many uncommon species, doubly welcome by reason of their charming condition and freshness. The next day I told a friend of my extraordinary adventures with the night-flyers. We agreed to make a trial of the plan in the forest apart from the honey-dew covered trees. My friend had a quantity of old honey; to this we added some sugar, and wended our way to the woods with the liveliest hopes of a grand night. In the forest a place was quickly selected for this second experiment, and we brushed over with our sweets a large surface of foliage. We now went about "mothing" until the time arrived to light our lamps. Upon approaching our artificial honey-dew, as I might call it, I was even more surprised and pleased than the night before at the spectacle presented to us. *Thyatira derasa* and *batis* appeared like gems on the leaves. These had our attention first, both for their attractiveness and their active habits, always on the move. The next species to share our admiration was *Aplecta herbida*; we had never seen a perfect specimen before, so our delight may be imagined. *Aplecta nebulosa* swarmed; in fact, became a perfect nuisance, for, like *Xylophasia polyodon*, it is generally in such a fluster that it disturbs and frightens away a more valuable moth. *Apamea gemina*, a species not always to be had, was plentiful, and *Grammesia trilinea* swarmed, and with them were some specimens of the curious variety known as *bilinea*; at that time a good example was scarcely in any cabinet. The remainder of the scene was enlivened with *Noctua brunnea* and *festiva*, with the usual common species of the genera *Agrotis* and *Miana*; also the more welcome *Hadena adusta*, *H. thalassina*, and *H. Genista*, as well as many others. We returned home highly delighted with our excursion. As soon as our stock of honey was exhausted, we had recourse to sugar alone, and found it equally effective. Edward Doubleday was at this time at home, and had the charge of my captures to set out in the absence of his brother. He used to say "I wish my brother home to help me set your captures, you bring so many good things." On Henry Doubleday's return from Paris he was surprised in

the extreme, and sent for me to learn the details. After a few nights' adventures with sugar he wrote to the late Edward Newman, telling of the utilisation of sugar for the capture of moths. An article in the 'Zoologist' sent the entomological world to the woods with the sugar-can and lanthorn, and thus began the now well-known practice of sugaring by which our collections were rapidly enriched with new species, with rarities, and, above all, with good and fresh examples.

VIII. ON THE FORMATION OF A LOCAL MUSEUM.

By J. E. HARTING, F.L.S., F.Z.S., Member of the British Ornithologists' Union.

[Read May 28th, 1881.]

It was observed by one of the most fascinating of English writers on local Natural History, that if the natural productions of every district had their local historian, our knowledge of the fauna and flora of this country would become more perfect than by any other means; and every one knows how agreeably and how perfectly the author of that sentiment carried it into practice.

Living in a remote village in Hampshire, before the days of railways, with few neighbours of education to exchange ideas with, and but few books of reference on his favourite subject (for few then existed), he was thrown almost entirely on his own resources; and yet he found abundant occupation for many years in examining the productions of his own parish, and in collecting materials for those agreeable Letters on Natural History which have fortunately been preserved to us, and with which every one is, or ought to be, familiar. As an English classic, every student should read Gilbert White's 'Natural History of Selborne,' and it will be surprising if he be not first attracted, soon amused, then deeply interested, and finally filled with a curiosity and longing to observe and examine for himself some of the many remarkable things in nature which are therein only partly unfolded.

If it be true that a poet is born, not made, the same cannot be said of the local natural historian. His occupation is not to conceive beautiful ideas and clothe them with equally beautiful words; but to arrive at great scientific truths by a course of patient and careful investigation, and the judicious collecting of natural objects illustrative of such truths.

Of the first part of such a course we need not here speak ; our present purpose is to offer some suggestions on the second ; and in so doing we cannot dwell too emphatically upon the value of a local museum when containing well-arranged and properly named collections of the natural productions of the district in which it is situated.

The late Professor Edward Forbes expressed the opinion that it is to the development of provincial museums that we must look in future for the extension of intellectual pursuits throughout the land. Well-arranged museums of every kind are now, in fact, an educational necessity in every highly civilised State ; and many such exist. But in how few of these do we find any portion of the museum set apart to illustrate the productions of the district ? The very feature which of all others would give interest and value to the collections—which would render it most useful for teaching purposes, has in most instances been omitted, or so treated as to be altogether useless.

Unfortunately, many country museums are little better than raree-shows. They contain an incongruous accumulation of things curious, or supposed to be curious, heaped together in disorderly piles, or neatly spread out with ingenious disregard of their relations. In nine cases out of ten the only label attached to a specimen is "Presented by Mr. So-and-so ;" the object of the presentation having been either to cherish a glow of generous self-satisfaction in the bosom of the donor, or, under the semblance of doing a good action, to get rid of rubbish that had once been prized, but latterly had stood in the way.

Curiosities from the South Seas, relics worthless in themselves, deriving their interest from association with persons or localities, a few badly-stuffed quadrupeds, rather more birds, some snakes in spirits, a stuffed alligator, part of an Egyptian mummy, a few Indian gods, a case or two of shells (the bivalves single, the univalves decorticated), a sea-urchin without its spines, a few common corals, the fruit of a double cocoa-nut, some mixed antiquities, partly local, partly Etruscan, partly Roman and Egyptian, and a case

of minerals and fossils—such is the inventory and about the scientific order of their contents.

The result of such an association as this of articles which have no sort of relationship with the rest, is to convert the whole into *rubbish*, using the word in the Palmerstonian sense of being “matter in the wrong place.” Not that such museums, however, are absolutely useless. In default of better, they are useful, just in proportion as they encourage the collecting instinct in the beholders. But it will be admitted by those who are best able to judge that the only way to make a local museum what it should be is to decline with thanks all offers of foreign curiosities, and objects of which no history has been preserved, and to which, consequently, no value can attach, and to confine attention to the collection of natural objects procurable within the confines of the county to which the Society limits its researches.

It is useless to attempt to vie with larger and older museums by accepting everything that may be offered; for not only would such a collection probably never rise above mediocrity, and would occupy a great deal more space than would be required for the arrangement of locally collected objects, but from an educational point of view it would never be so valuable as a well-arranged series of minerals and fossils, animals and plants, collected within what may be termed the Society's area.

If for special reasons it should be deemed desirable to preserve within the museum walls other objects than these, they might be arranged in a separate department, and kept quite distinct from the educational series.

At the last meeting of the British Association, held at Swansea in August, 1880, Dr. Günther, in his presidential address to the Biological Section, referred in marked terms to the value of provincial museums when properly designed and arranged.

“The direct benefit,” he observed, “of a complete collection of the flora and fauna of the district in which the provincial museum is situated is obvious, and cannot be exaggerated.

"The pursuit of collecting and studying Natural History objects gives to the persons who are inclined to devote their leisure hours to it a beneficial training for whatever their real calling in life may be; they acquire a sense of order and method; they develop their powers of observation; they are stimulated to healthy exercise.

"Nothing encourages them in this pursuit more than a well-named and easily accessible collection. This local collection ought to be always arranged and named according to the plan and nomenclature adopted in one of the numerous monographs of the British fauna and flora in which this country excels; and I consider its formation in every provincial museum to be of higher importance than a collection of foreign objects."

After such an expression of opinion from so high an authority as the Keeper of the Zoological Department in the British Museum, it will be unnecessary to dwell further on this part of the subject, although we may add briefly that such a museum, well carried out, is especially helpful to science in fixing a date to the fauna and flora of the district explored, and in giving the material means of contrasting it with the condition of both at a later period in the ever-changing circumstances of an increasing neighbourhood.

As to the mode of forming and arranging such collections as those contemplated, opinions will doubtless differ. The following suggestions are offered for consideration:—

In addition to such antiquities as may be discovered in the neighbourhood, and secured from time to time,¹ the three chief divisions or departments of a museum will correspond with the three great kingdoms—the Mineral, the Vegetable, and the Animal.

¹ Of such antiquities as are not to be obtained for the museum, drawings or photographs might be procured.

[In the Museum of the Essex Field Club no antiquities will be preserved, except such as may fairly serve to illustrate the subjects comprised in the department of *Pre-historic* Archaeology. All other antiquities should be deposited in the museum of the Essex Archaeological Society at Colchester.—Ed.]

The MINERAL department may be arranged according to the successive strata, or layers, of which the soil consists. The several kinds of peat, sand, gravel, clay, &c., may be preserved in glass jars, and the various fossils which may be from time to time discovered should be arranged according to their position in the scale of animated beings.

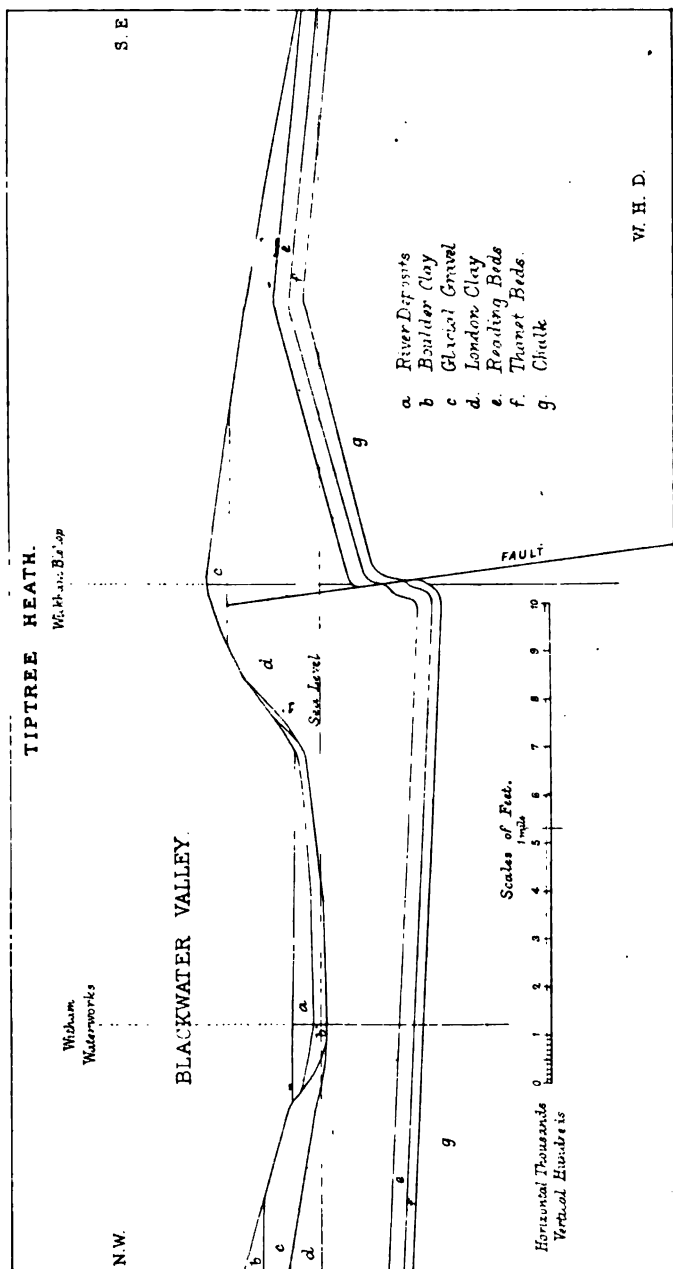
The VEGETABLE department may have two leading divisions, the first comprising the non-flowering plants, as Lichens, *Fungi*, Mosses, and Ferns, sometimes called *Acotyledons* (without *cotyledons* or seed-leaves), or *Cryptogams* (concealed fructification, or seedless), because they do not bear manifest flowers, nor produce seeds containing an embryo, as do the great classes of *Dicotyledons* and *Monocotyledons*.

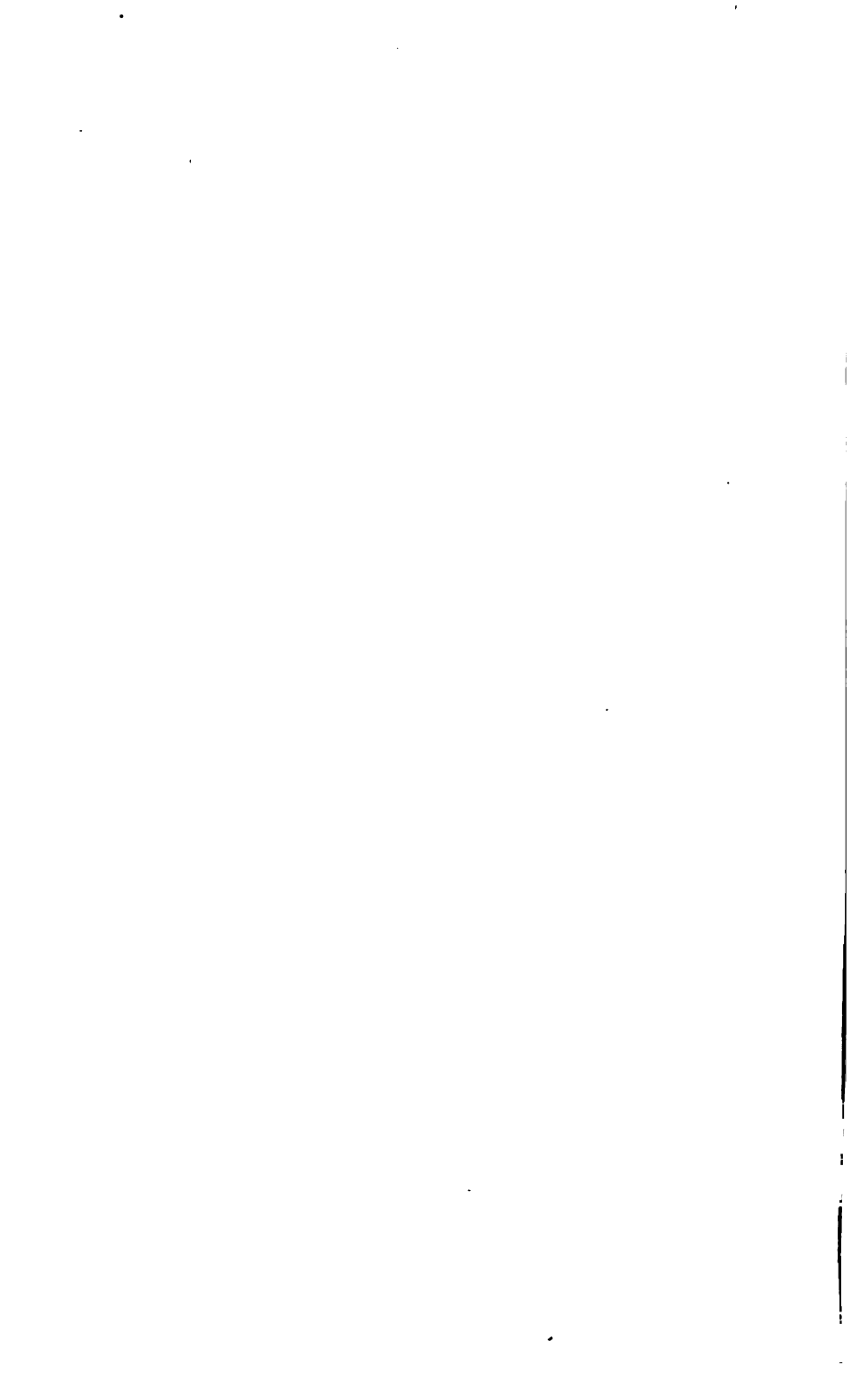
The second division comprises the flowering plants, and may have two leading subdivisions, illustrative of the two great classes into which flowering plants are to be found grouped in nature.

These subdivisions are named, according to the manner in which the wood is formed, *Exogens* and *Endogens*.

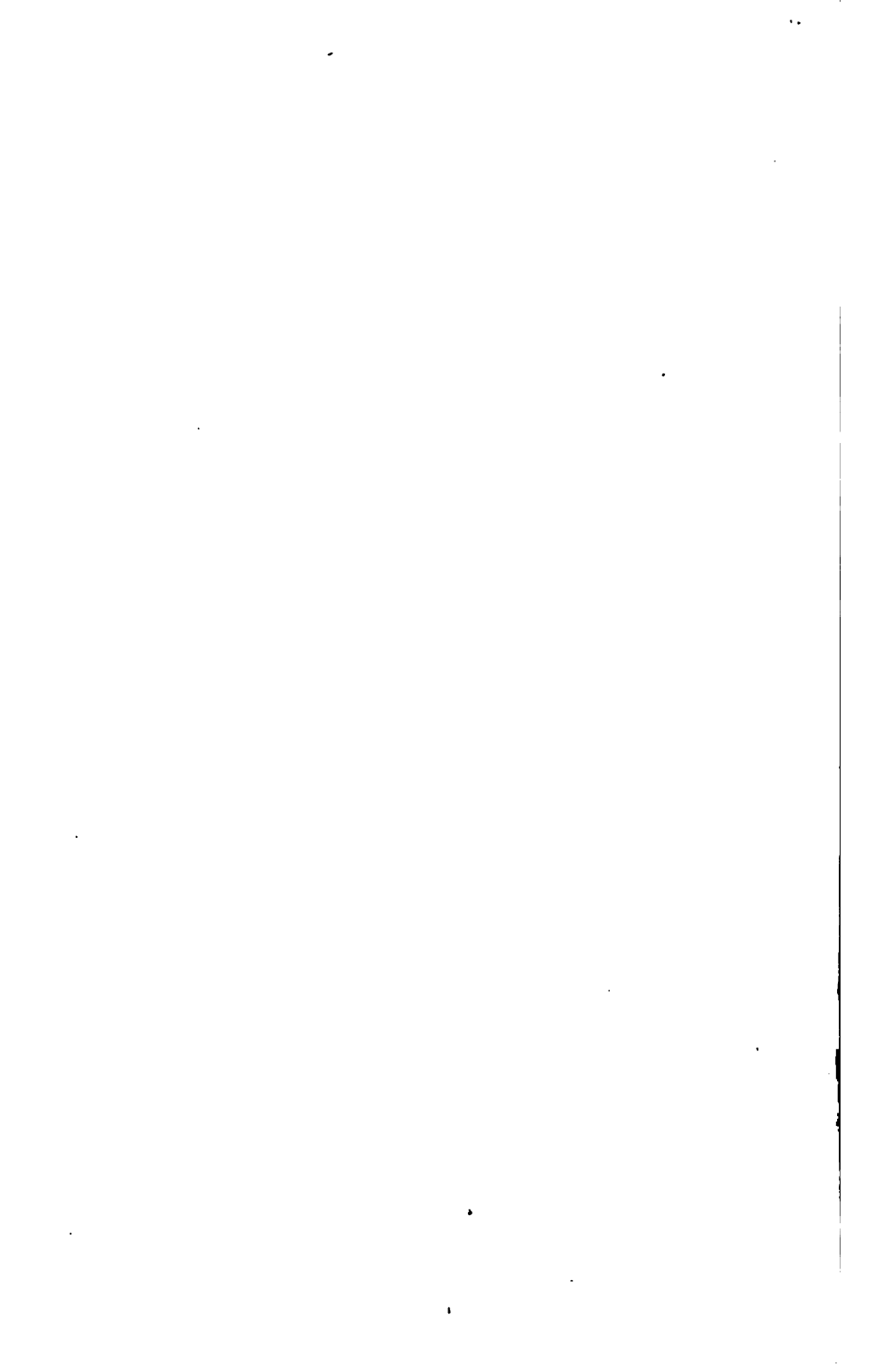
Exogens (producing outwards), so called from the new wood being formed in rings placed outside the old, are also called *Dicotyledons*, from the seed having two rudimentary leaves; the plants in their early condition, while yet enclosed in the seed, nearly always having two (sometimes more) small opposed lobes or leaflets. In this subdivision the parts of the flowers are most frequently in *fives* or *fours*, and the small veins of the leaves are usually irregularly netted, as *e.g.* in the oak and the beech.

Endogens (producing inwards), so called because the plants, having woody stems, form bundles of wood which do not usually increase in thickness year by year; once formed, they remain unaltered in diameter, scattered through the pith-like substance of the stem. In this class (also called *Monocotyledons* from the seed having only one rudimentary leaf) the parts of the flowers are usually in threes, and the veins of the leaves, excepting in a few orders, are parallel, or if diverging are not irregularly netted, as *e.g.* in wheat, grass, reeds, and rushes.









In the arrangement of the ANIMAL kingdom the two leading divisions will be the *Invertebrata* and the *Vertebrata*—animals *without* and animals *with* vertebræ, or spinal columns. The invertebrate animals may be grouped in the following chief subdivisions, called "Sub-Kingdoms," viz.:—*Protozoa*, *Cœlenterata*, *Echinodermata*, *Vermes*, *Arthropoda*, and *Mollusca*. The vertebrate animals will, of course, comprise the Fishes, Reptiles, Birds, and Mammals.

With regard to the mode of preserving the various specimens of animals and plants which may be collected, we cannot do better than quote from a letter of the late Professor Bell, addressed some years since to the secretary of a local natural history society, who was at that time engaged in projecting a museum.

The quadrupeds which it would be necessary to preserve in any local museum are comparatively few and small. The Bats, which are the especial objects of interest, should be skinned and slightly stuffed, and may be pinned or attached with thread to small pieces of thin wood or card-board.

Other quadrupeds, such as the smaller *Insectivora*, *Carnivora*, and *Rodentia*, should all be well and naturally stuffed, as well as the birds, and should be kept in closely glazed cases. Most of the Reptiles are better preserved in spirits. The skull of every quadruped should be preserved (by having the flesh removed, and being then macerated in cold water for some days), as well as the head and feet of the more remarkable birds.

The Bats, Voles, and Shrews, are objects of special inquiry, and collectors should endeavour to obtain specimens which would settle the question as to the identity or distinctness of several so-called species.

Fish, like Reptiles, are best preserved in spirit,² and by having a thread passed under or through the gill-covers,

² In this view we have ventured to differ from Professor Bell, who suggested the preservation of fish by taking off half the skin, sticking them on board, and varnishing them—a course which, for many reasons, is objectionable.

may be attached to the stopper of a glass jar, and so suspended in an upright position.

Land and fresh-water shells, like birds' eggs, are best kept in drawers, so as to protect them from the light, which would otherwise soon cause their colours to fade. The best way to free the shells from their inhabitants is to plunge them into boiling water, and keep them therein long enough to ensure death, when the animal is easily removed.

With regard to the collection and preservation of insects, every elementary work on Entomology gives full directions.

Plants should be dried between sheets of botanical drying-paper, which should be repeatedly changed during the process, and kept under pressure, and, when dried, should be attached by narrow strips of gummed paper to stouter white paper of a uniform size—folio is best—and kept in portfolios, or drawers. Palæontological specimens should be kept in glass cases to be readily observed, and careful notes made of the localities in which they have been found.

Every specimen, whether animal, vegetable, or palæontological, should have a ticket attached to it, on which its generic and specific names, locality, date, and name of the finder, should be legibly written; while any additional notes of interest should be entered in a book kept for the purpose.

One of the most interesting results of these local collections will be the light thrown upon the geographical distribution of plants and animals, and the relation between the geology of the district and its organised productions.

Having, then, briefly considered the uses and advantages of a local museum, and the simplest mode of collecting and arranging the objects to be preserved therein, it may not be out of place to offer some suggestions as to management, which will be best entrusted perhaps to a Committee and an Honorary Secretary.

The Committee having determined certain preliminary considerations, such as the housing of the collections, the question of Museum Funds, &c., it will be found desirable to adopt some such rules (amongst others) as the following:—

1. That all specimens, which must be in a good state of

preservation, and in a state calculated to keep well, shall be sent to the Honorary Secretary of the Museum Committee, accompanied by the name and address of the collector, the name of the object (if then determinable), the locality where, and the date when, collected, with any other details of interest, legibly written.

2. That a record of facts interesting in natural science shall be preserved in the museum.

3. That a list of plants and animals found in the district be drawn up for future revision and publication.

4. That an accurate register of the daily reading of the barometer, thermometer, and hygrometer, be kept in the museum.

5. That a descriptive catalogue be kept of the contents of the museum.

6. That by degrees, as the museum finances shall admit, a collection of works on natural science be formed and kept in the museum for the use of members and students visiting the museum.

Other rules, besides those here suggested, will doubtless occur to the Committee, or become necessitated by circumstances which are not here considered. Enough has perhaps been said to pave the way for a careful consideration of the question whether the formation of a local museum is not well calculated to give members of the Society and their friends an additional source of improvement, healthy recreation, and worthy occupation.

IX. INFUSORIA : WHAT ARE THEY ? THEIR COLLECTION AND INVESTIGATION.

By W. SAVILLE KENT, F.L.S., F.Z.S., F.R.M.S.

[An Address delivered at the Field Meeting held at Chigwell, June 25th, 1881.]

It has been my privilege to accompany you this afternoon in your pleasant Field Meeting in the search for microscopic spoils, and more particularly to assist you, so far as circumstances would permit, in the collection of the special objects of my investigation, namely, Infusoria.

Although Jupiter Pluvius has unfortunately been so unpropitious as to seriously interfere with our good intentions, I yet purpose now to address you briefly upon the more important features of this highly interesting organic group, trusting that the remarks I make may induce some, or, I would even hope, many, members of the Essex Field Club to embark also upon its systematic study.

It is in the first place desirable that I should place before you a concise definition of the series of organisms that, in accordance with our present knowledge, have to be included within the Infusorial world, such definition being requisite to enable the student to know what to accept and what to reject from among the multifarious forms that will present themselves to his notice at the very outset of his investigations, and which were actually comprised in the group by the earlier authorities. Even the latest complete treatise in the English language, Pritchard's 'History of the Infusoria,' that relates to this organic group, is based upon the lines laid down half a century ago by C. E. Ehrenberg, and includes, in a similar manner, a heterogeneous assemblage of animal and vegetal organisms belonging to half a dozen or more distinct classes (Diatoms, Desmids, Rotifers, Rhizopods,

Radiolaria, &c.), in no way connected with each other, and whose amalgamation with the Infusoria can no longer be seriously entertained.

The Infusoria, as now delimited, may be defined as microscopic, unicellular animals, or Protozoa, whose locomotive or prehensile organs take the form of one or more long whip-like appendages, or "flagella"; of variously developed fine hair-like appendages, or "cilia"; or of a more or less complete system of extensile and retractile tubular structures, or "tentacula." It is with reference to these three modifications of their appendages that the Infusoria are conveniently divided into the three primary sections, or classes, of the Flagellata, the Ciliata, and the Tentaculifera, to one of which groups the student must relegate the subject or subjects of his investigations as a preliminary step towards their specific identification. Out of these several classes the microscopist entering upon an examination of this fascinating organic series will do well, perhaps, to concentrate his attention firstly upon the class Ciliata, the majority of its members being of appreciable size and adapted for study and identification with comparatively low powers of the compound microscope. Confining his energies to this class, he will find that the organisms he collects conform to one out of four structural formulæ, which serve as bases for the subdivision of the class into as many subordinate groups or orders. Thus, in one very extensive series, the fine hairs or cilia are closely alike in size and character, and are distributed uniformly over the entire surface of the body. This order, known technically by the title of the Holotricha, is typified by the "Slipper Animalcules" (*Paramecium*), common in infusions; the "Toothed Animalcules" (*Nassula* and *Prorodon*); and the "Swan Animalcules" (*Trachelocerca*). In the second order, that of the Heterotricha, the cilia—as the term implies—are of diverse kinds; those of the general surface of the body being very fine, as in the preceding group, to which, however, is superadded a much larger and stronger series which surrounds or conducts to the oral aperture or mouth. This order includes some of the largest

and handsomest representatives of the Infusorial class as exemplified by the Stentors or "Trumpet Animalcules," and the genera *Bursaria* and *Spirostomum*. In the third order, that of the Peritricha, the cuticular ciliary series is entirely suppressed, a spiral or circular series surrounding the anterior border, while a second supplementary girdle is occasionally developed towards the central or posterior region. This division is interesting as containing the exceedingly elegant "Bell Animalcules" or Vorticellidæ, all characterised by their normally sedentary habits, and being, as in *Vorticella* proper, attached singly to their fulcræ of support through the medium of a complex retractile pedicle, or, as in the case of *Carchesium* and *Epistylis*, building up through repeated subdivision extensive tree-like colonies. Other Vorticellidæ, such as *Cothurnia* and *Vaginicola*, inhabit elegant stalked or sessile protective sheaths or loriceæ, whose orifices are sometimes guarded by opercula or lid-like structures. Some one or more members of this very characteristic group reward a dipping from any weed-grown pond. The fourth and last group of the Ciliata is known as the Hypotricha; it includes all infusorial forms which, like *Euplotes*, *Stylonychia*, and *Oxytricha*, have locomotive cilia developed only on the lower or ventral surface of the body. These cilia are usually diversely modified in the same individual, taking the form of setæ, styles, or uncini, and constitute veritable ambulatory organs wherewith their possessors literally walk, insect-wise, over the surface of submerged objects.

The animalcules comprised in the relatively small group of the Tentaculifera—including *Acineta*, *Podophrya*, and their allies—were for a long while regarded as embryonic conditions only of certain Ciliata. The tables have now, however, been so far turned that not only are they recognised as constituting an independent series, but they are also shown to originate from ciliated germs, and consequently represent an even more highly developed class than that of the Ciliata. All the Tentaculifera are distinguished by their possession of tubular, and mostly retractile, tentacle-like appendages, which are utilised by the free forms for locomotive purposes, but

are more especially subservient in both the erratic and sedentary species as prehensile organs wherewith they seize and transfer to their own bodies the protoplasmic contents of other Infusoria. The animalcules belonging to the tentaculiferous class are not inferior to the Ciliata in regard to size, and on account of their chiefly sedentary habits afford peculiar facilities for systematic investigation.

Should the microscopical investigator be so far satisfied with his explorations among the ciliate and tentaculiferous classes of the Infusoria as to determine upon a like study of the Flagellata or monadiform animalcules, he will find his path beset by more formidable obstacles, though *en revanche* he will be entering on a new and interesting field that has up to the present time been so superficially explored that he may look forward with almost absolute certainty to meeting with an abundant harvest of species not yet placed on record in the scientific annals; while in connection with an overwhelming majority of those already known, but the scantiest data have been registered concerning their life and developmental histories. All the Flagellata are notable for their minute size, a total length of the 1-2- or 8-1000th parts of an English inch being a common measurement. They consequently need the higher powers of the compound microscope—a 1-8th inch objective and upwards—for their satisfactory investigation; while even with such apparatus a considerable amount of patience and manipulative skill is essential for the correct definition of the number and character of their diversely modified appendages. Up to within a comparatively recent date the Flagellata, as a clearly-defined animal group, could be scarcely said to exist, its members being intermingled with the unicellular flagelliferous Protophytes or lowest plants, and from which indeed they are even yet in many instances not easily distinguished. The application, nevertheless, of the standard that has been selected personally as the distinction between these flagellate Protozoa and Protophytes, namely, the capacity to ingest solid food and the possession of a rudimentary respiratory organ—the pulsating contractile vesicle—by the animals, and

the entire absence of such a faculty or structure among the plants, has rendered practicable the isolation of a very extensive series of animal forms, whose members, it is anticipated, may be almost indefinitely augmented. Even as so far known, the number of flagellate Infusoria is as considerable as that of the Ciliata, and promises in the long run to be transformed into a very substantial majority. A long and intimate acquaintance with the flagellate class has enabled me to propose its subdivision into three primary series, which may take rank with the several orders of the Ciliata already enumerated. The characters presented by these Flagellata are indeed far more substantial in kind than those cited in connection with the Ciliata. They relate not merely to the nature and distribution of the locomotive appendages, but to important distinctions in the characters of the ingestive system. Thus in one very extensive series, for which I have proposed the title of the Flagellata-Pantostomata, there is no distinct mouth or oral aperture, food-substances being received indifferently—after the manner of an *Amaba*—at all points of the cuticular surface. Such genera as *Monas*, *Heteromita*, or *Anthophysa* afford fitting examples of this Pantostomatous group. In a more advanced section or order the area of food-ingestion, while not distributed over the entire surface, nor so limited as to form a distinct mouth, occupies a discoidal interspace of considerable extent at the anterior extremity of the body. It is this order, distinguished by me by the title of the Choano-Flagellata, or “Collared Monads,” that embodies those very minute and beautiful forms in which an extremely delicate extensile and contractile collar-like expansion embraces the base of the flagellum, and, through the adhesiveness and circulation of its substance, constitutes a marvellously elaborate and efficient trap for the capture of passing food. For the first discovery of this very remarkable flagellate group Science is indebted to Professor H. James-Clark of America, who, in the year 1866, figured and described no more than four distinct species. A few years later these several types were discovered by myself upon this side of the Atlantic, and, through the devotion of

further time to the study the number of known varieties has been augmented by me to little less than fifty. As shown in the drawings of the species herewith submitted,¹ the group abounds with forms which vie with, or even excel, in beauty and elegance of design the Peritrichous Vorticellidæ, whose dendritic colony-stocks and flask-like loriceæ are moreover here reproduced, or more correctly pretypified, in bewildering variety.

In the third group of the Flagellata that has to be enumerated, differentiation has so far progressed that a distinct oral aperture is in all instances present. To this higher order, that may be appropriately distinguished by the title of the Flagellata-Eustomata (or "True-mouthed Monads"), belong especially the comparatively large *Euglenæ*, whose cloud-like multitudes, taken together with their brilliant colour, frequently constitute a conspicuous and important element in the superficial strata of our road-side ponds and ditches. In addition to the three typical flagellate orders already cited, there yet remain two or three numerically small series which connect these typical orders with either the class Ciliata, or with lower groups of the Protozoa. In this manner the order Cilio-Flagellata, as typified by *Peridinium* and its allies, directly connects the two classes of the Flagellata and Ciliata, its representatives possessing a conspicuous girdle of locomotive cilia in addition to a flagelliform appendage. The two small orders of the Rhizo-Flagellata and Radio-Flagellata, as instituted by myself, contain as yet but a few obscure forms (e.g. *Reptomonas*, *Rhizomonas*, and *Actinomonas*), which connect in a similar manner the typical Flagellata with the lower groups of the Protozoa, known as the Rhizopoda and Radiolaria.

A general outline of the limits of the Infusorial series being included in the foregoing remarks, a few of the more favourable conditions under which these microscopic organisms may be successfully sought for and studied may now be indicated. The most attractive and prolific hunting ground for

¹ [Being duplicates of plates illustrating the treatise, 'A Manual of the Infusoria' (Bogue), by the author, now in course of publication.—ED.]

the student of Infusoria is undoubtedly furnished by weed-grown ponds. From these he may always expect to reap an abundant harvest. Fragments of the weeds, more particularly the finely divided varieties, such as *Myriophyllum*, *Ranunculus*, and the rootlets of Duckweed (*Lemna*), should be placed in a bottle and examined carefully for colony-stocks of the "Trumpet" and "Bell" animalcules, which may be easily detected with the assistance of a pocket lens, and may even be recognised as flocculent growths upon these plants with the unaided vision. Many of the free Ciliata, when abundantly developed, will also be rendered visible as glistening specks progressing through the water with that peculiar locomotive action distinctive of its kind. Excepting in the case of the social *Euglenæ*, and a few other types, whose presence, as already mentioned, lends a distinct coloration to the water, the collection of the Flagellata is pre-eminently an act of faith, and not of sight. Notwithstanding that the weeds gathered may appear to the unassisted eye, or even as examined with the pocket lens, completely barren, they may on submission to the higher powers of the microscope be found to be teeming with flagelliferous types. The collector, moreover, should be advised not to immediately throw away what appears on a preliminary investigation to be an unproductive gathering. Such gatherings often contain an abundance of latent germs, which after an interval of a few days develop luxuriantly on the surface of the plants, or on the sides of the receptacle that contains them. Two of the first and most remarkable flagellate types yet met with, *Rhipidodendron Huxleyi* and *Spongomonas sacculus*, as delineated in the exhibited plates ('Manual of the Infusoria,' pl. xvi., figs. 4-9, and pl. xii., figs. 17-28), were thus obtained fortuitously by myself from bog-water collected on Dartmoor, and which, as gathered and submitted to preliminary examination, betrayed no trace of abnormal infusorial life. Within a few days, however, little rust-red patches made their appearance upon the sides of the bottle, and developed within a brief interval into the colony-stocks, represented in the plates submitted; these were not only distinctly visible to the

unassisted eye, but had a diameter or total length of as much as from the one-tenth to the half of an inch. The inhabitants of these relatively large tree-like or sac-shaped fabrications in no case yielded a greater measurement than the 1-4000th or the 1-8000th part of an English inch, so that the number included in the larger aggregates is almost beyond calculation.

The student must by no means confine himself to the collection and examination of water-plants in his search for Infusoria. Innumerable forms are to be met with growing upon other aquatic animals: insect larvæ, molluscs, and the more minute Crustacea, yielding an abundance of different forms, their "fluffy" appearance, as seen with the naked eye or with the aid of a lens, being a sure sign of the presence of the required organisms. The little Entomostracan—*Cyclops*—may be more especially mentioned as commonly supporting on its body and limbs a perfect forest-like growth of infusorial types, including, it may be, representatives of each of the three primary sections referred to in my earlier observations. In this manner the class Ciliata is usually typified by one or more species of *Epistylis*; that of the Flagellata by *Cephalothamnium* and *Deltomonas*; while that of the Tentaculifera may be represented by one or two species of *Podophrya*; and all of which Infusoria, as so far known, are obtained under no other conditions.

Although ponds, ditches and other expansions of water may be recommended to the student as his first area of exploration, these represent but one out of numberless sources from whence Infusoria are to be derived. A multitude of species are essentially parasitic, living within the intestinal viscera of higher animals. Many terrestrial insects, worms, and molluscs, discharge the duty of hosts to special varieties. The frog, in common with other Amphibia, supports quite an abundant infusorial fauna, consisting of both ciliate and flagellate types; while even the higher Vertebrata, including horses, sheep, oxen, and man himself, are not exempt from infusorial dependents.*

* [An article descriptive of the chief varieties of parasitic Infusoria has been contributed by the author to the 'Popular Science Review' for 1880, p. 298.—Ed.]

Artificial animal and vegetable macerations yield very numerous forms, and are especially rich in the flagelliferous Monads. Up to a comparatively recent date the derivation of the Infusoria produced so abundantly in hay infusions has been a marked subject of contention among physiologists, some arguing that they were generated there spontaneously, and others that they were developed from extraneously derived pre-existing germs. By carefully conducted experiments it has been my good fortune to successfully demonstrate not only that the germs or spores of Infusoria abound in hay previous to maceration, but also that the Infusoria which produced these germs flourish in the living condition in the grass previous to desiccation, remaining in a state of temporary encystment during dry weather, and reawakening to life with each shower of rain or fall of dew.*

A few concluding suggestions respecting the collection and observation of Infusoria may not prove unacceptable. From whatever sources samples of water containing specimens are derived they should be kept separate, and have a label indicating the place and date of collection affixed. Not only are species mingled indiscriminately prone to prey upon each other, but rare varieties may appear upon the scene whose precise habitat cannot be successfully traced after such admixture of the material collected. The student is advised to habituate himself to make drawings, however rough, of every species he encounters, placing by the side of each sketch a registration of its precise dimensions, taken with the aid of an eye-piece micrometer. The essential structural points that he should further seek to verify are the position and character of the oral and excretory apertures, and similar data with reference to both the contractile vesicle and the nucleus or endoplast if distinctly developed. The nature and distribution of the cilia or other appendages will, of course, receive primary attention; the precise number and

* [The whole question of biogenesis *versus* abiogenesis is fully discussed in chap. iv. of the 'Manual of the Infusoria'; and Mr. Kent's original and valuable observations, above alluded to, are detailed at length at page 140, *et seq.*, of the same work.—Ed.]

relative length of these appendages in the flagellate class is of high importance, but is ascertainable in many cases only in connection with a prolonged and careful examination. The manner in which food is ingested by the Flagellata, whether by a distinct mouth or through the general surface of the body, should be accurately determined. Such observation may be greatly facilitated by the addition to the water of a little carmine or other pigment from an ordinary box of water-colours.⁴ Special attention should be bestowed upon the reproductive phenomena. All Infusoria multiply rapidly by simple subdivision or fission, and it should be noted whether this fissive process takes a longitudinal, transverse, or oblique direction. Some forms give birth to living embryos, while among the Flagellata it generally happens that the whole body-mass splits up into spore-like elements. Sometimes this reproductive process is preceded by the fusion or conjugation of two or more animalcules. It should be the object of the investigator to ascertain and register as many data as possible connected with these several phenomena.

⁴ [Until the last few years it was thought impossible to preserve most of the Infusoria for future study and reference, but Mr. Kent has elsewhere described ('Manual of Infusoria,' p. 113) the value of osmic acid as an agent for their conservation. A drop of the solution in distilled water (1 per cent. solution) should be placed on the covering glass before the latter is placed over the specimen. All structures, such as cilia, cirri and flagella, the internal endoplast, and in *Euglenia* and its allies, the colours also, are stated by Mr. Kent to be perfectly preserved. The animalcules thus killed may be fastened down as permanent preparations, without the addition of any other preservatives, and may be stained with the ordinary agents, hæmatoxylin, eosin, picro-carmine, &c., known to histologists. The objection to osmic acid is that it is very costly and excessively poisonous, its vapour having an intolerable odour, and attacking the eyes in a very painful manner. A solution of iodine in potassium iodide is without these objections, and acts in a similar, and almost equally efficient, manner. Another harmless agent is afforded, according to M. du Plessis, by a saturated solution of potassium permanganate; and for the preservation of the stalked Vorticellidæ very dilute spirit (1 in 10) is recommended. For manipulative details the student may usefully consult Huxley and Martin's 'Practical Biology,' Carpenter and Beale on the microscope, and Schäffer's 'Practical Histology,' in addition to Mr. Kent's *magnum opus*, above cited.—Ed.]

It may be finally submitted that no complete Infusorial Fauna of any one district in the United Kingdom has, up to the present time, been placed on record, and that it lies in the power of the members of a Naturalists' Field Club so favourably located as the one I now address to not only secure for themselves and their fellow-members an inexhaustible fund of instruction and recreation by a painstaking investigation of the Infusoria distributed throughout the Forest districts or the wider field of the County at large, but by following out such a study, systematically and faithfully, they may materially benefit and advance the cause of Science in connection with a field of research having, as so far explored, a literally limitless horizon, and where it may advisedly be said, "the harvest truly is plenteous, but the labourers are few."

**X. REPORT ON THE EXCAVATION OF THE EARTHWORK KNOWN AS
AMBRESBURY BANKS, EPPING FOREST.**

**By Major-General A. PITT-RIVERS, F.R.S., President of the
Anthropological Institute.**

[Read at the Chelmsford Meeting of the Club, August 18th, and at the
York Meeting of the British Association, September 5th, 1891.]

PLATES III., IV., and V.

EPPING FOREST contains two camps about two miles apart, concerning which there are some local traditions. These camps owe their preservation to the fact of this region having been always forest and not cultivated ground; and this is a point worth noting on the part of those who are inclined to lay stress on the value of tradition as evidence of time and place. It is certain that neither Cæsar nor Boadicea, nor any of the heroes and heroines of olden times, to whom these things are ascribed, had any special eye for locating themselves in places which might not in after years be destroyed by the plough; yet tradition concerning these people hangs naturally about such places as remain to us from ancient times, rather than about those innumerable spots in our long and highly cultivated country in which ancient monuments have been destroyed by agriculture.

If anyone desires by practical experience to test the value of transmitted evidence, let him in the first place sit down, as I have done, to write a paper on Ambresbury Banks from materials derived almost exclusively from the notes of other gentlemen whose knowledge of the matter is greater than his own, and who having diligently watched the excavations made there, whilst he was otherwise engaged in London or elsewhere, have been good enough to supply him with all he has to base his paper upon. Let him observe how easy it

might be under such circumstances, by losing some of his notes and misinterpreting others, even in these days of developed intellect, with all the means of accuracy at command in writing, printing, mapping, lithographing, photographing, &c., to produce something which would have a strong affinity for nonsense concerning the matter in hand. Let him then suppose himself to be an ancient Briton deriving his information solely from oral sources. Let him assume that he has to tell his story not to the members of the Essex Field Club, but to a band of armed and painted fanatics strongly fortified with preconceived opinions, and determined to hear nothing which shall not accord with what they knew before. Let him then suppose his story has to be handed on by them to other savages furiously predisposed to different views, and that after that it has to serve its time for eighteen centuries as subject-matter for nursery and supper-table tales, each successive narrator clothing it, as the painters of the Middle Ages did the characters represented in their pictures, in vestments of their own particular time and place; he will see that the evidence afforded by tradition for any event of prehistoric or non-historic times having occurred in the particular locality attributed to it is unfit to hold any but a place of very secondary importance as an element of scientific investigation. I shall, therefore, make my apologies to Queen Boadicea for saying no more about her connection with this locality than has been said by others in papers that have been written upon these camps. There is no objection whatever, that I am aware of, to the supposition that Queen Boadicea made her last stand here against Suetonius, if anyone desires that such a theory should be held; but in this paper I have to deal solely with the materials unearthed from beneath the ramparts.

Two papers, both by Mr. B. H. Cowper, have been sent to me for perusal; one published by the Epping Forest Fund in 1876, the other read before the meeting of the Royal Archaeological Institute at Colchester in the same year. The former is accompanied by plans of both camps by Mr. W. D'Oyley, of Loughton. To these I would refer the

reader for all that has been known about these camps up to the present time, as it appears to me undesirable to trench upon them by quoting passages which might deprive them of their proper place in the history of this investigation. Not having been the result of actual excavations they are necessarily speculative, but they have served to keep up interest in the subject, and may therefore be said to have contributed materially to the present results. I would, however, remark with respect to the Ambresbury Camp that the somewhat angular form given to it has not conveyed to my mind, as it appears to have done to some, the impression that it was the work of the Romans. Reference to Mr. D'Oyley's new plan, accompanying this paper (Plate III.), in which, at my suggestion, the shading of the slopes around the camp are given, will show that the configuration of the ramparts is adapted to the features of the ground.¹ On the east side a ravine (A) approaches the camp from the valley below, and divides into two forks (A B, A C) as it nears the camp; the rampart at this place is drawn across the points of these forks so as to sweep down them. On the south side also advantage is taken of another ravine (D) to strengthen the fortifications on that side. These are points which, although influencing the principles of defence which have prevailed at all times, are more especially British as distinct from Roman. The Romans, caring more for their internal discipline and the position of their cohorts than for external defence, arranged their camps on geometrically constructed lines, and often disregarded natural features altogether. It is true that at the northern corner (E) of Ambresbury Camp the rampart turns at an abrupt angle, but this is owing to the fact that at that particular spot there are no natural features to guide camp builders: the ground is a dead flat, and as the turn had to be made somewhere it was made abruptly, as so often occurs in British camps. An example of this is seen in the

¹ Levels were carefully taken by Mr. D'Oyley for the purpose of this investigation around and through the camp at distances of 100 feet or less. The results are given in the plan, the datum being, of course, one of the Ordnance bench-marks.—ED.]

Camp at Seaford ('Journ. Anthropol. Inst.' vi. 287), which I have shown by excavations similar to the present to be British, and in many other British entrenchments that are known to me, when it became necessary to leave the natural line of defence which is determined by the ground and cut across the top of a hill, the turn was made abruptly. On this account I ventured at the meeting of the Society, which was held last year ('Proceedings,' vol. i., xxiv.), to say that there was nothing in the formation of this camp which predisposed me to regard it as the work of the Romans.

Mr. Meldola, the President of the Essex Field Club, having done me the honour of consulting me on the subject, I suggested at a meeting of the Club, held on 8th July, 1880, that the only means of obtaining any further clue to the origin of the earthworks was by means of an excavation in the rampart. The exploration of other camps excavated has almost invariably brought to light relics which, though of little or no intrinsic value, were such as to afford certain evidence of date. When these camps were thrown up, in all probability large numbers of men were collected to do the work; these men encamped upon the ground previously to commencing operations, and strewed about the surface bits of broken pottery, knives, or various fragments of utensils in common use. The ditch was then dug on the outside, the materials from it were thrown up to form the rampart, and all that was lying on the surface was by this means covered up and preserved. A section through the rampart and ditch would reveal these objects; sometimes relics of interest are found, sometimes mere fragments and refuse; but in all the camps I have explored bits of pottery at the least have been discovered, which were sufficient to give some idea of the period of construction. The meeting above referred to having decided to adopt this course, a subscription was opened, and an application for permission to make sections through the ramparts was made to the Epping Forest Committee of the Corporation of London, and readily granted. It was decided to commence with Ambresbury Banks; a spot was selected on the west side of the camp

which was bare of trees, and which afforded a good section of the earthwork, and the cutting was commenced on May 30th, 1881. (See 'Journal of Proceedings.') The excavation occupied about nine working days, and was carefully executed by four or five men in the employ of Mr. Cuthbert, contractor, Loughton. The section was 12 feet wide, extending from the foot of the silting of the interior slope to about 18 feet beyond the counterscarp; it included the removal of the rampart within those bounds down to the old surface line and the excavation of all the silting of the ditch, as well as the small outer rampart beyond the ditch, which at this place is only very slightly marked. The excavations were very carefully watched in relays by members of the Club during the nine days that the work lasted, including the President (Mr. Meldola), Mr. W. Cole (Hon. Secretary), Mr. W. D'Oyley (Hon. Surveyor), Mr. H. A. Cole, Mr. Alfred Lockyer, Mr. H. J. Barnes, Mr. N. F. Robarts, Mr. T. Fisher Unwin, Mr. W. Hodge, the Rev. Linton Wilson, Mr. F. H. Varley, and myself.

As it has been thought advisable by the Club that the programme which I drew up for the guidance of the directors of the excavations—being the result of previous diggings, and therefore possibly of use to future explorers—should be recorded, it is here inserted, together with the imaginary section accompanying it:—

"Let A, B, C, L, Fig. 1, Plate IV., be the original shape of the rampart; and L, D, E, F the original shape of the ditch. Then by denudation in the course of ages the outline will have assumed the line, G, M, N, I, W, the amount of denudation depending of course on the nature of the soil, the time, and various other causes. You will not have the advantage of a chalk soil in which the lines of demarcation of the different deposits are much more clearly defined than in most soils, and therefore you will have to look out sharply for them. In the references to the section I have named the different parts which are important in describing the positions in which the relics are found, as the evidence of date entirely depends upon that. A trench should be commenced well behind the

foot of the interior slope at s, as wide as you please, say ten feet, digging down to r, v, so as to be well below the old surface line g, l, z, which in your soil will probably only be marked by a little white decayed matter representing the old turf. Whatever is found in the *body of the rampart*, a, m, n, l, and especially on the old surface line a, l, must be of the date of the construction of the camp or earlier; but things found in the silting of the interior slope, m, g, a, may be of various dates subsequent to the construction of the camp, the age of an object thus found depending upon its proximity to the old foot of the interior slope a. This is a very important point to notice, as any mistake between the *body* of the rampart and the *silting* would give an entirely false idea of the date.

"In like manner the ditch should be dug in spits down from the top. What is found in the upper spit is quite recent; the second spit older; and things of the date of the camp will be found only in the bottom spit.

"It will be found that the point r, marking the present centre of the bottom of the ditch, is always to the outside of the old bottom, x,—perhaps 3 or 4 feet, according to circumstances, but always outside,—more silting having gone from the rampart into the ditch than into the interior. I have had sometimes to dig down as much as 3 feet below g before finding the old surface line. The old surface in this place must have been very uneven at the time the rampart was made."

Fig. 2, Plate IV., is a section, by Mr. D'Oyley, through the centre of the cutting at Ambresbury Banks, showing the seams in the rampart and ditch, and the position of each object found. As the position of the objects in a vertical plane is all that is necessary to take notice of, everything is projected in this section. Each object as it was found was numbered, put into a small pill-box, ticketed on the spot, and marked on the section. At the conclusion of the excavations the entire collection was sent up to me for comparison with similar objects found in the ramparts of other camps. The following were the objects found:—

No. 1. An outside flint flake with bulb of percussion, and

another with one bulb and one facet. Found in the silting of the interior slope.

No. 8. One flint chip and piece of pottery, too much worn for identification. From the body of the rampart.

No. 5A. Piece of the rim of a pot, red on the outside and grey in the interior, without any grains of quartz or sand in its composition; the sides of the pot 0·40 inch thick, the rim projecting about 0·24 inch, and 0·84 inch deep. This might be Romano-British. Found in the silting of the interior slope at a spot where marks of burnt earth and charcoal indicated that a fire had been lighted at the foot of the interior slope when the rampart was intact. A representation of this fragment is shown in the chromo-lithograph, Fig. 1, Pl. V.^a

No. 6. Piece, apparently, of pottery, resembling No. 8 in texture, but too much worn for identification; it had no grains of quartz in its composition. Found in the body of the rampart on the old surface line.

No. 7. Fragment of pottery about 1·25 inch square and 0·86 inch thick, brick-red on one side, which is the outside, and dark brown in the interior of the substance and in the inside of the pot; it has no grains of quartz in its composition. On the inside are striations, which might perhaps be the marks of the lathe turning on a potter's wheel, but the outside is uneven and shows no such marks. Found in the body of the rampart on the old surface line.^b This fragment resembles fragments found at Cissbury Camp, near Worthing, and believed to be British or Romano-British, the red-brick colour distinguishing it from No. 5.

^a [The Society is indebted to the author for this costly plate. General Pitt-Rivers, being of opinion that the objects found were typical of the *kind* of relics likely to be exhumed from similar earthworks, very generously added the chromo-lithograph to the Report for the information of future camp-explorers. The fragments themselves, with the other specimens described in the paper, will be deposited in the Museum of the Corporation of London, at the Guildhall.—ED.]

^b On further examination I am inclined to doubt whether these striations imply lathe turning, as the scratches are not perfectly parallel to one another.

No. 8. Fragment of rim, about 2 inches by $1\frac{1}{2}$ and 0.40 inch thick; it has large grains of white and grey quartz, and red, grey and black pebble, in its composition; it is dull red on the outside and inside of the pot, and brown in the interior of the substance; the thickness of the pot is only slightly enlarged at the rim to about 0.42 inch, and the rim is a different shape from No. 5. It is hand-made, very uneven on its surface, and the rim rudely formed. Such a piece of pottery might safely be pronounced of British manufacture. Found in the body of the rampart on the old surface line. See the chromo-lithograph plate, Fig. 2, Pl. V.

No. 10. One flint flake or chip with bulb of percussion and one facet, and fragment of pottery about 2 inches by $1\frac{1}{2}$ and 0.82 inch thick; brick-red on the outside and inside, and dark brown or black in the interior of the substance; no grains of quartz. Resembling No. 7 in quality; no marks of lathe. British or Romano-British. Found in body of rampart on or near the old surface line. See Fig. 8, Pl. V.

No. 12. Fragment of rim $1\frac{1}{2}$ inch by 1 and 0.44 inch thick; dull red outside and inside, and red-brown in the interior of the substance; no grains of quartz in its composition, of smooth pasty texture; the rim projects more than No. 8, but is less evenly formed than No. 5. It is hand-made, and must be British. From the body of the rampart.⁴ Fig. 4, Pl. V.

No. 18. A piece of much-corroded iron, about 2 inches long and 0.50 inch thick. Found in the silting of the ditch, about $2\frac{1}{2}$ feet beneath the surface, but too high up to be necessarily, or even probably, of the age of the construction of the camp.

No. 14. Piece of pottery, about 1 inch square and 0.18 inch thick, with small grains of sand in its composition, both thinner and harder than that found in the rampart, but much weathered; probably wheel-turned. It is of a uniform red-brown colour throughout, and was found 8 feet beneath the

⁴ [On or near the old surface line; exact position unknown. Found by Mr. Fisher Unwin in examining the earth just thrown into the cart by the workmen digging out the old surface line spit.—Ed.]

surface in the silting of the ditch, but too high up to be necessarily of the age of the construction of the camp.

No. 15. Fragment of pottery, about 1 inch round and much weathered, 0·88 inch thick, brick-red on one side, the outside and the rest black; resembling some of the fragments found in the rampart. Found in the bottom of the ditch.

No. 16. A fragment of pottery, 0·68 inch thick, red on both sides and dark in the middle; too much weathered to enable any idea to be formed of its shape, but resembling No. 12 in composition. Found near bottom of ditch. In the same spot was also found a small fragment of a rim, 1·25 inch by 0·25 inch, and 0·24 inch thick; it appears to have been more evenly formed than some of the pieces in the rampart, but was unevenly baked, being red-brick on both sides and black in the middle; perhaps lathe-turned. Such a fragment might be Romano-British.

Besides the above there has been sent to me another fragment without any number, 1½ inch by 1 inch and 0·84 inch thick. This was found near the marks of fire at the foot of the interior slope of the rampart, and therefore probably deposited there subsequently to the construction of the rampart. It is brick-red on the outside, and black on the inside and in the middle; it contains fragments of quartz and sand; it is harder than the fragments found in the rampart, and has distinct marks of lathe-turning in the interior or concave side. See Fig. 5, Pl. V. It is remarkable that this, the only fragment which can with certainty be pronounced to be lathe-turned, should be found in a position to lead to the inference that it may be of later date than the rampart; the only other piece which showed any indication of lathe-turning, and that doubtfully, being No. 7 (No. 5A. Fig. 1, the fragment which has the most evenly-formed rim, was found near the same spot as the fragment represented in Fig. 5, and was also in the silting of the interior slope). Grains of quartz or pebble do not necessarily indicate any period, as both the Romans and the Normans made pottery of this kind, but harder and better baked than the specimens under consideration. The rude construction of the pottery found in

rampart is shown by the difference of colour in the interior of the substance. This is due to imperfect baking, and implies a primitive condition of the art. Up to what period hand-made pottery was used in this country we have no means of knowing; but where the fragments are entirely hand-made it is reasonable to suppose it to be of early date. The two kinds of pottery found here—the smooth quality, with or without large grains of quartz, and the rough and sandy quality, often red-brick colour on the outside—have been found by me associated together in other camps; they are British or Romano-British, that is, British before or after the Roman Conquest. There is no ornamentation on any of the fragments found at Ambresbury Banks which would enable one to fix the date more precisely. Judging by their quality none of the pieces are Roman or Norman, and no fragment of Samian ware has been found. A single fragment of Samian pottery on the old surface line beneath the rampart would have determined the entrenchment to be Roman.

Although a few flint flakes have been found in the rampart they are not in sufficient number to prove with certainty that they were in use at the time of the construction of the rampart; they may have belonged to the soil, and have been turned up with it. They are usually much more plentiful in those camps which belong to the Bronze Age, for there can be little doubt that they were used late into the Bronze Age, if not more recently; and this fact alone appears to me to imply that this camp is more recent than the Bronze Age.⁵

The excavation of the silting in the ditch showed that it had originally been triangular in its section and pointed at the bottom, the escarp rising at an angle of 45°, and the counterscarp probably at the same angle, though now flatter; it was 22 feet wide at the top and 10 feet deep, and it has since silted up 7 feet from the bottom. The present centre of the ditch is now about 2 feet to the outside of the old

⁵ Although a considerable number of flints were sent to me for examination, the majority, with the exception of those here named, were natural forms, and showed no evidence of human agency.

centre, and the present crest of the rampart has gone back some feet towards the interior owing to the greater denudation of the superior slope. The rampart must originally have been about 10 feet high above the old surface line; it is now 7 feet high, and the relief above the bottom of the ditch must have been 20 feet. The base of the silting of the anterior slope may be estimated at about 16 feet, and there is some indication in the seams of the old interior slope; but this measurement is uncertain, as is often the case in British ramparts. I have not usually found the bottoms of the ditches of British camps pointed. At Cissbury, Caburn, and Sleaford, there were flat bottoms along which the people might traverse, whereas in the earthwork improperly named *Cæsar's Camp*, near Folkestone, but Norman in its origin, both ditches were pointed like the present one; but we have no sufficient evidence as yet for determining whether there was any persistency in the form of ditches in British times. I have always assumed, however, that where the old sides of the ditches are found to stand at an angle of stability of 45° , as in the present case, it indicates that the entrenchment was intended to be more or less a permanent work. I should mention that my information as to the form of this ditch is derived entirely from Mr. D'Oyley's reliable section and from his verbal account of it, and not from personal observation, as I had left the camp before the bottom of it was excavated.

Whilst excavating the ditch the gentlemen present were struck with the number of rounded and apparently selected pebbles, 2 to 8 inches in diameter, which turned up in the silting near the bottom, and which led them to the conjecture that they must have been imported for use as sling-stones. This observation is the more valuable on their part from the fact that they were not aware at the time that like results had been obtained from other camps. In the Kentish and Sussex camps, I had found and recorded the discovery of similar pebbles in the ditches of works, facts which in those cases were the more noticeable owing to the soil being chalk, and so, therefore, not a pebble-producing formation. The pebbles in these places had been imported from the distant

sea-shore, whereas at Ambresbury they were probably obtained from Tertiary deposits close by. This independent observation, however, confirms the impression that slings were in common use by the defenders of these camps.

In conclusion I have only to add that, although at the request of the Council I have written the paper from the materials which have been furnished to me, it is to those gentlemen who have so diligently conducted the explorations the credit of this investigation is due: to Mr. Meldola, with whom the investigation originated; to Mr. W. Cole, the Honorary Secretary, by whom all the arrangements have been made; and more particularly to Mr. D'Oyley, the Honorary Surveyor to the Club—to whose excellent plans and sections on this no less than on former occasions the Society is indebted for the means of recording with accuracy the result of its labours. To these gentlemen my acknowledgments are due, not only as an honorary member of the Society for their contributions towards the matter in hand, but in a special manner for their courtesy to me in supplying the data and correcting the omissions which this paper may have contained.

If I am asked whether I consider the results of the investigation are conclusive, I can only reply that, within certain limits, the age of the entrenchment appears to have been fixed. I have on other occasions found it necessary to make three or four cuttings into the ramparts before satisfactory results could be obtained. If it be the wish of the Essex Field Club to settle the question whether the camp, being a British one, was erected before or after the Roman Conquest, further excavations can alone decide the point; but I think the Committee of Exploration may fairly be congratulated upon having, with the slender means at their disposal, achieved so much, having solved by means of a single section a large portion of the problem which has exercised the best wits of the neighbourhood from the days of Camden to our own time.

[As the excavated soil was removed it was carried to a spot a few yards from the scene of operations, and there

"clamped" for measurement. The desiccating action of the atmosphere soon rendered it friable, and as the clayey agglutinated lumps broke up, objects previously hidden in masses of earth could be more readily detected. Consequently, in the operations of carrying back the soil to the ramparts, the workmen lighted upon several pieces of broken pottery and two or three flint flakes, which were faithfully preserved and given into Keeper Butt's care, and by him duly handed to the Hon. Secretary. In this collection there are four or five pieces of pot of considerable size, as well as several smaller fragments, all presenting characters similar to the specimens enumerated in General Pitt-Rivers's Report. The larger shards may be thus described:—

a. Piece of Pottery irregularly triangular in shape, with a slight curvature inwards; about 2·75 in. long, by 1·7 in. wide, and 0·45 in. thick. Brick-red for about one-third of its thickness on the convex or outside, and very superficially so on the concave side, where the colour is not so rich and the surface probably less fired. Interior substance blackish brown, coarse in texture, with small angular fragments of pebble intermixed. Apparently a fragment of a vessel of considerable size.

b. Irregularly-shaped piece of pot, about 2·4 in. from corner to corner, by 2 in. broad, and 0·4 in. thick, with a slight curvature towards the inner or less-fired surface. Colour and texture in all respects like "a." On the convex surface are to be noted a few almost obsolete striations, similar to the markings referred to by General Pitt-Rivers in his description of No. 7 (page 61).

c. Small rimmed pot-shard, 1·2 in. by 0·8 in., about 0·40 in. thick at the rim, and about 0·25 in. at the thinner part. The rim is sloped-off towards the outside at an angle of about 45°. The colour is black throughout, except on the outer surface, where a very superficial brown-red tinge obtains. Texture somewhat harder than "a" and "b," and very different in character. Small fragments of quartz and grains of whitish pebble are abundantly intermixed.

d. Small fragment, 1·2 in. by 0·85 in., and 0·4 in. thick. Colour and texture similar to "a" and "b."

Various very small fragments like "a" and "b," and one corresponding in texture with "c," were found with the above. Two flakes may be recorded—one (e) of light-coloured flint, with indistinct bulb of percussion and three facets; the other (f) of darker flint, with good bulb and four facets: both specimens are about 1·5 in. long, and abruptly truncated at the end where the flaking-blow had been given.

It is much to be regretted that these specimens were not found *in situ*, so that their exact positions could have been marked upon the section; but it is almost certain that they came from well within the body of the rampart, judging from the positions in which they were discovered in the "clamped" excavated soil. The Editor has therefore thought well to describe them here, as they appear to afford valuable confirmatory evidence of the results obtained during the actual excavations.—ED.]

**XI. ON THE ORIGIN AND DISTRIBUTION OF THE BRITISH FLORA.
WITH AN APPENDIX ON THE RIVER-BASINS OF ESSEX AS
NATURAL-HISTORY PROVINCES.**

By Professor G. S. BOULGER, F.L.S., F.G.S.

[Read at the Field Meeting held at Danbury, August 18th, 1881.]

LAST week will be memorable in the annals of British botanical science. Ten days ago I stood by the open grave of Hewett Watson, who devoted the genius and labour of his life to the elucidation of the geographical relations of British plants; and two days later appeared the eighth edition of Professor Babington's Manual,—a work that, in its critical discrimination of allied forms, has during the last thirty-eight years ably reflected the advance of Botany in England.

The work of these two men is related to the two divisions of the subject on which I am about to address you. First, I wish to trace the origin of our flora by comparing it with other assemblages of plants; and secondly, I wish to sketch the distribution of its constituents through the British Isles.

The most unobservant traveller cannot fail to notice the difference between the plants of one district and those of another. If it may not have fallen to his lot to contrast the luxuriance of a tropical jungle with the barren tundras of Arctic Siberia, or the pastures of our temperate plains with the pine forests of Scandinavian mountain-slopes, or the stunted birches and willows of their summits, he will have seen near his own home that the flowers of the field are not those of the wood, and that those of the sea-shore are not those of the river-banks.

Such experience leads us all at first to put down the distribution of plants as the effect of differences of climate—using the word in a broad sense; nor can it be denied that climate is a most important factor in the problem. You will,

however, I think, understand me when I say that climate rather determines what shall not grow in a given locality—what shall be exterminated if it attempt to grow—than what shall grow; if I remind you that plants do not always flourish most in their native home, as witness the familiar instance of the luxuriance of our English watercress and white clover in New Zealand, and that many plants do not occur native in climates admirably suited to them. In considering the causes which have led to our British flora being what it is, we must undoubtedly bear in mind that ours is an insular climate. There being more moisture in the air the extremes of both heat and cold are moderated, and our climate is better suited to herbaceous perennials than to annuals; but the recent separation of our islands from the continent causes their flora to be in the main an extension of that of Germany, altogether different from those “insular floras,” rich in endemic or peculiar types, which characterise “oceanic” islands. The theory of evolution shows us that the real key to geographical distribution is to be found in the community of origin of allied forms, and their subsequent dispersal. The subject was first reviewed from this standpoint by Mr. Bentham in 1869.¹ He then pointed out that the vegetation of the globe must always have been separable into three great latitudinal zones,—the northern, the tropical, and the southern. The subsequent migrations of plants seem to have tended rather from north to south and from east to west than in the reverse directions.² In explanation of the

¹ In his Presidential Address to the Linnean Society.

² Sir Joseph Hooker, in his Address to the Geographical Section of the British Association at York, 1881, alludes to a lecture, by Mr. Thieslton Dyer, “On Plant Distribution as a field of Geographical Research” (‘Proceedings of the Royal Geographical Society,’ vol. xxii., 415, 1878), which I have not seen, wherein he argues that “the floras of all the countries of the globe may be traced back at some time of their history to the northern hemisphere.” Sir Joseph also refers to Count Saporta’s essay, entitled “L’Ancienne Végétation Polaire,” in the ‘Comptes Rendus,’ of the International Congress of Geographical Science for 1875, which also I have not seen. “Starting from Buffon’s thesis, that the cooling of the globe having been a gradual process, and the Polar regions having cooled first, these

first of these lines of passage Mr. Darwin has suggested³ that the northern forms existing in their own homes in greater numbers, owing to the greater extent of land in the north, have attained a higher stage of perfection or dominating power; but Dr. Asa Gray's⁴ botanical confirmation of the truth of Bishop Berkeley's dictum that "westward the course of empire takes its way" remains at present an ultimate fact.

In seeking for the geological origin of our existing floras it seems of little use to travel backwards beyond the Cretaceous period. The flora of the Jurassic consists mainly of ferns, conifers and cycads; the oldest known dicotyledon being a species of poplar (*Populus primeva*), found in beds of Middle Neocomian age at Komé, in North-west Greenland;⁵ the flora of this locality consisting in the main, however, of ferns and conifers, among the latter being the genus *Sequoia*. At the neighbouring locality of Atané a totally distinct flora is found,⁶ in beds belonging to the Upper Cretaceous, and including, with few cycads, sequoias, and other conifers, a predominance of dicotyledons; among which are a fig, two magnolias, and plants apparently belonging to the orders

must have first become fit for organic life, Count Saporita proceeds to assume that the termination of the azoic period coincided with a cooling of the waters to the point at which coagulation of albumen does not take place, when organic life appeared in the water itself. . . . The Polar area was the centre of origination of all the successive phases of vegetation that have appeared on the globe, all being developed in the north; and the development of flowering plants was enormously augmented by the introduction during the latter part of the secondary period of flower-feeding insects, which brought about cross-fertilisation."

³ 'Origin of Species,' chap. xii., p. 340, in ed. 6.

⁴ 'Darwiniana.'

⁵ Professor Nordenskjöld, in a lecture to the Royal Swedish Academy, given in the 'Geological Magazine,' November, 1875, p. 529; and Professor Oswald Heer, in 'Flora fossilis Arctica,' Zurich, 1868—1875. For these and other references to the geological part of my subject I am indebted to an article on "The Cretaceous Flora," by Professor Morris, 'Popular Science Review,' 1876, pp. 46—59.

⁶ Nordenskjöld, *loc. cit.*, and Dr. R. H. Scott, 'Geol. Mag.,' February, 1872, p. 71.

Proteacea and *Leguminosa*. At La Louvière,⁷ in Hainault, in clays belonging to the period of the Gault, is a flora consisting of conifers and cycads, like those of Kome and Folkestone; whilst at Aix-la-Chapelle,⁸ in sands of Upper Chalk age, we have a far different assemblage of plants, including, with the ferns, *Asplenium*, *Lygodium* and *Gleichenia*; with *Sequoia* and other conifers, species of screw-pine and numerous *Proteacea* (amounting to nearly 70 species out of 200), some belonging to such genera as *Banksia*, *Dryandra* and *Leucospermum*, which are now confined to Australia and the Cape. With these are *Eucalyptus*, fig, bog-myrtle, willow, poplar, oak, and beech. In the lignites of the Dakotah group,⁹ on the plains of Eastern Kansas and Nebraska, a remarkable flora has been discovered, embracing such forms as poplar, willow, birch, oak, bay, cinnamon, liquidambar, magnolia, tulip-tree, maple, and plum; and in New Zealand,¹⁰ in beds also of Cretaceous age, we have the beech, with many representatives of the *Myrtacea*, and of genera still existing in that country. Professor Lesquereux is of opinion¹¹ that the existing arborescent flora of North America originated in the Dakotah group, and subsequently migrated to Europe. In the London clay, at Sheppey, we have fruits of Proteaceous

⁷ Coemans, 'Mem. de l'Acad. roy. de Belgique,' tome xxxvi.

⁸ Lyell, 'Student's Elements of Geology,' 1st ed., p. 278, Morris, *op. cit.*, pp. 49—51, and the numerous papers there quoted.

⁹ Admirably described and discussed by Professor Lesquereux, 'The Cretaceous Flora,' Washington, 1874.

¹⁰ Dr. Hector, 'Trans. New Zealand Institute,' vols. ii. and vi.

¹¹ *Op. cit.*, and 'Geol. Survey of Montana,' 1871, p. 314. Note also Mr. De Rance's remarks in the geological appendix to Sir George Nares' 'Narrative of a Voyage to the Polar Sea':—"In the overlying American Eocenes occur types of plants occurring in the European Miocenes and still living, proving the truth of Professor Lesquereux's postulate that the plant types appear in America a stage in advance of their advent in Europe. These plants point to a far higher mean temperature than those of the Dakotah group." "This," adds Mr. A. R. Wallace ('Island Life,' p. 183), "is very important as adding further proof to the view that the climates of former periods are not due to any general refrigeration, but to causes which were subject to change and alternation in former ages as now."

plants; and at Bournemouth this group occurs, with figs, bays, and *Papilionaceæ*, the whole presenting a subtropical and somewhat Australian aspect. It is, however, the luxuriant and wide-spread flora of the Miocene period that has chiefly forced upon geologists the question of climate in the past. At Ceninghen, in the North of Switzerland, we have a flora including 465 species, of which 166 are trees and shrubs, half of them being evergreens. They comprise sequoias, cinnamons, tulip-trees, and many other American genera, together with maple, ash, plane, oak, and poplar.¹³ At Breslau, at Dantzic, at Bovey Tracey, and in the Island of Mull, we have some of the same forms;^{13*} but even in 70° of north latitude, on the west coast of Greenland, is a flora of a but slightly more northern character, including evergreens, a walnut, a plum, vines, and a magnolia;¹³ whilst in Spitzbergen, more than 8° further north, occur water-lilies and swamp-cypress with pines and sequoias;¹⁴ and even in Grinnell-land, within 8½° of the Pole, occur elms, guelder-roses, the Norway spruce, and the swamp-cypress.¹⁵ The most satisfactory explanation of these wide-spread indications of a warm climate in north temperate regions is the theory, so ably advocated by Mr. Alfred Russel Wallace, in his most suggestive 'Island Life,'¹⁶ of the lower elevation of the land within the arctic circle, and the access of warm currents from the Indian Ocean through the Red, Caspian and White Seas, and from the Pacific, to Polar regions. During the same period Professor Heer's valuable maps, in his 'Primeval World of Switzerland,'¹⁷ indicate continuous land from North-west Africa through Spain, and the Bay of

¹³ Lyell, *op. cit.*, pp. 190—198; Wallace, *op. cit.*, p. 177; and Heer, 'Flora Tertiaria Helvetia.' ^{13*} Heer, 'Miocene Baltische Flora'; Pengelly and Heer, 'Phil. Trans.,' 1868; Duke of Argyll, 'Quart. Journ. Geol. Soc.,' 1851; Lyell, *op. cit.*, pp. 214—223.

¹³ Heer, 'Fossil-Flora von Alaska,' 1869; 'Flora fossilis Arctica'; Lyell, *op. cit.*, p. 215.

¹⁴ Heer, *op. cit.*

¹⁵ Wallace, *op. cit.*, pp. 177—179.

¹⁶ Wallace, *op. cit.*, pp. 183—192.

¹⁷ Translated by Mr. W. S. Dallas, London, 1876.

Biscay to the British Isles, to the importance of which I shall presently again allude.

Mr. Wallace has, I think, brought forward sufficient arguments to enable us to conclude that these geographical changes would prevent the recurrent glacial periods necessitated by Dr. Croll's hypothesis from having more than the local effect in the Flysch deposits between Switzerland and Vienna, and the ice-scratched boulders in the upper Miocene of Turin.¹⁸ Directly, however, we pass to the Pliocene a cooling of the climate seems to have taken place, as seen in the pines and alders of the Cromer forest bed,¹⁹ and the presence of the Arctic willow (*Salix polaris*) and the dwarf birch (*Betula nana*) in the clay deposit overlying the sub-tropical miocene lignite at Bovey Tracey.²⁰ The glacial periods probably then commenced with elevation which would cause a southerly extension of the ice and cold, driving the Miocene flora southwards. The more temperate species could then cross the Tropics along the chain of the Andes, and from the Caucasus through the Himalayas and the mountains of Aracan and Java to the north of Queensland. Probably, at a still earlier period, a migration had taken place along this last line, not only to Tasmania, but to New Zealand, the more modern flora of West Australia being then shut off by a central sea.²¹ The period of elevation was

¹⁸ Wallace, *op. cit.*, pp. 171, 172.

¹⁹ Rev. G. Henslow, in "The Origin and Present Distribution of the British Flora," *Trans. Watford Nat. Hist. Soc.*, vol. ii. (1879), p. 138.

²⁰ Henslow, *loc. cit.*, and Lyell, *op. cit.*, p. 221.

²¹ "Thus the plants of *Fuegia* extend northward along the Andes, ascending as they advance. Australian genera reappear on the lofty mountain of Kinibalu in Borneo; New Zealand ones on the mountains of New Caledonia; and the most interesting herbarium ever brought from Central Africa, that of Mr. Joseph Thomson, from the highlands of the lake districts, contains many of the endemic genera, and even species of the Cape of Good Hope. Nor does the northern representation of the south temperate flora cease within the tropics; it extends to the middle north temperate zone; Chilian genera reappearing in Mexico and California; South African in North Africa, in the Canary Islands, and even in Asia Minor; and Australian in the Khasia Mountains of East Bengal, in East China, and Japan."—Sir Joseph Hooker's Address to the Geographical Section of the British Association (York, 1881).

followed by one of great depression, reducing Great Britain to an archipelago, in which only alpine plants would survive. Then followed a second continental period, readmitting the flora of Europe to the British Isles, but so rapidly succeeded by depression to present levels that, reckoning the flowering plants and ferns of Great Britain at 1425, only 970 had time to reach Ireland.²²

As we travel eastwards from the Mediterranean, through the Levant, Caucasus, Persia, the Himalayas, China, and Japan, we find the traces of the retreating American Miocene flora more and more numerous. The fan-palm, the plane-tree, and the walnut of the East, and the magnolias of the Himalayas, China, and Japan, have the meaning of their distribution still more strongly brought out by the discovery of a tulip-tree in Central China.²³

Mr. Bentham points out²⁴ that the northern flora has undergone a specialisation into three secondary floras, the Arctic-Alpine, the Temperate, and the Mediterranean-Caucasian. The first of these, common in some degree to the Old and New World, has been driven into every latitude, surviving on the mountains when glacial gave way to warm conditions, often on their southern slopes. The Temperate flora consists largely of genera common to every longitude, easterly extensions of American groups, such as the deciduous trees; whilst the Mediterranean-Caucasian, comprising six-sevenths of the species of Europe, and bounded by the deserts of Africa and Arabia, but having outliers on the mountains of Tropical Africa, may represent the remnant of the flora of Europe previous to the Arctic-Alpine and American Miocene invasions.

Whilst we are not concerned with the Tropical flora, that of the disconnected lands of the South has an important bearing on our present subject. In the West of Europe is a

²² Hewett Watson, cited by Mr. Wallace, *op. cit.*, p. 320.

²³ Moore, 'Journal of Botany,' 1875, p. 225; Oliver, 'Natural History Review,' 1862; and W. T. T. Dyer, article "Distribution," *Encyclop. Britan.*, 9th ed., vol. vii. (1877), p. 287.

²⁴ *Op. cit.*, summarised by Dyer, *op. cit.*

group of plants, including the gorses, broom, and allied plants, *Lobelias*, *Gladiolus*, *Sibthorpias*, and heaths, which are "more nearly allied to corresponding Cape species than they are to each other." The severity of the winter checks the extension of these plants to the East; and they seem to have travelled from Natal to Abyssinia, and from thence to the Cameroons and the Atlas Mountains. This migration may have taken place partly as a return current at the close of a glacial period; but it would seem more probable that some of these plants, now confined to Portugal, the Asturian Mountains of the north of Spain, and Ireland, are the relics of a still earlier migration, probably Miocene. Ireland may not have been so entirely submerged in glacial times as Great Britain.

The earliest botanical work of Mr. Hewett Watson was a pamphlet entitled 'Outlines of the Geographical distribution of British plants,' printed in 1882, in which he groups our flora under eight types of distribution, namely, British, English, Intermediate, Scottish, Highland, Germanic, Atlantic, and Local or doubtful. At the Cambridge meeting of the British Association, in the following year, Professor Edward Forbes, with his characteristic acumen, stated independently conclusions almost identical.* The plants of Watson's British, English, Intermediate, and Scottish types Forbes grouped under the name of Germanic. Those termed by Watson "Germanic" plants, found in the East and South-East of England, and mainly affecting a limestone or chalky soil, he termed Kentish; whilst of the seventy species constituting Watson's Atlantic group he separated eleven, namely, six species of Saxifrage, two heaths, *Arbutus*, *Menziesia*, *Arabisciliata*, occurring in Ireland, under the name of Asturian, from their nearest continental habitat; terming the remainder Armorican, from their affinity to the flora of Normandy and Brittany. Disregarding the accidentally associated Kentish group, and putting on one side the Local

* Afterwards elaborated into his memoir 'On the connexion between the existing Fauna and Flora of the British Isles and the Geographical Changes which have affected their Area.'—Mem. Geol. Survey, vol. i. 336.

and doubtful species, we may well adopt Forbes's title of Germanic, which applies to 1059 out of 1425 British species, since their extension into Scotland, or their exclusive occurrence in the higher latitudes of that country, are questions of secondary importance as compared with their continental distribution. For the Highland type, including 120 species, we may use the more general term of Arctic-Alpine, retaining the names Asturian and Armorican for two other types or subfloras.²⁵ With the exception of two or three waifs from America,²⁷ the whole British flora occurs on the Continent of Europe, as we might expect, considering the recent geological date of the separation of our islands. Though, however, the time which has elapsed since this separation has not been sufficient for local forms of specific importance to originate, it is quite possible that a minute study of what are known to botanists as critical species, such as the aquatic *Ranunculi*, the brambles, roses, hawkweeds, and willows, may disclose varieties that are not only peculiar to the British Islands, but to particular districts.²⁸ If then we wish to investigate the distribution of plants within the limits of Great Britain, we

²⁵ The revised classification will therefore be as follows :—

Germanic (1186):—	Species.
British	582
English (including Forbes's Kentish) .	536
Intermediate	37
Scottish	81
Arctic-Alpine	120
Armorican	59
Asturian	11
Doubtful	49

Total No. of species on Watson's estimate . . . 1425

²⁷ These are *Eriocaulon septangulare*, a North American species found in Skye, the Hebrides, and from Antrim to Connemara; and *Spiranthes gemmipara*, also a United States plant, which occurs in County Cork.

²⁸ No doubt the closer comparison of English critical forms with those of the Continent will prove that many, if not all, occur in both districts; still it can hardly be doubted that the distribution-areas of segregates will prove more limited than those of aggregates. This line of inquiry, which requires considerable acumen, is as yet almost untouched.

require a scientific division of the country into provinces. This I have attempted, so far as England is concerned, in a paper recently published by the Geologists' Association.²⁹ We could hardly have a better guide to critical botany than Professor Babington's 'Manual'; and for the systematic examination of the plants of our county we are fortunate in possessing Mr. Gibson's 'Flora of Essex.' In the appendices to this work Mr. Gibson compares the Essex list with those of plants found in the adjacent counties; and similar tables are given for Middlesex in Messrs. Trimen and Dyer's *Flora* of that county. Unfortunately the subdivisions adopted by Mr. Gibson are not the natural lines of watershed dividing the river basins. These undoubtedly afford the most scientific boundary lines, and in the botanical map of England in my paper, to which I have just alluded, Essex falls partly into three provinces—(1) the basin of the Thames and the South-East, including in this county the valleys of the Lea, the Roding, and the Marditch; (2) East Anglia, to which belong the valley of the Blackwater, in which we now are, that of the Colne and the Stour, and that of the Crouch; and (3) a small district near Saffron Walden drained by the great Ouse. Whilst I should not be sorry if our Club were the means of adding to the four British species peculiar to Essex, I should be still more glad to hear of the rediscovery of any of those plants which Mr. Gibson enumerates as lost, and shall be fully satisfied if my remarks are the means of directing the attention of a small number to the geographical relations of our plants.³⁰

²⁹ "On the Geological and other causes that affect the Distribution of the British Flora," *Proc. Geol. Assoc.*, vol. vi., No. 9.

³⁰ Among the authorities to which I have been specially indebted are Mr. J. G. Baker's 'Botanical Geography' (1875); Mr. Benthams Presidential Address for 1869; Professor Morris's article, "The Cretaceous Flora" (1876); Professor Lesquereux's work with the same title (1874); Mr. Wallace's 'Island Life' (1880); the various works of Professor Heer, and of Mr. Watson; Professor Forbes's essay; Professor Dyer's article "Distribution" in the 'Encyclopædia Britannica' (1877); and Professor Henslow's paper, with the same title as the present one, in the *Watford Society's Transactions* for 1879. I have not yet seen Count Saporita's

APPENDIX.

ON THE RIVER-BASINS OF ESSEX AS NATURAL-HISTORY
PROVINCES.

[Read September 24th, 1881.]

PLATE VI.

At the request of our Secretary I have drawn a sketch-map of our county, divided, for purposes of Natural-History investigation, into provinces and subprovinces according to the river-basins, and have added the following explanations :—

Essex falls into three Provinces : those of (A) the Thames and South-east, (B) East Anglia, and (C) the East Fen and Secondary. Besides the narrow strip of land in the south of the county which drains directly into the Thames, in the first province are included that part of the county which drains into the Lea, the Roding, the Pym, the Ingrebourne, and other smaller streams. I may here remark on the difficulty I have found in obtaining accurate information as to minor streams. Those who live on their banks are ignorant of their names and of their courses. Like too many of the natural features of the country, they are beneath the notice of the county historian, and the writers of topographical articles and the draughtsman of small-scale maps think the brook that flows on for ever of less importance than such transitory accidents as noblemen's seats or parks, and accordingly omit it altogether, or, worse still, record it inaccurately. It would be a service to our society, and to the best interests of Essex, if some local member would draw up a thorough account of the topography of these small streams, the position, character and altitude of their sources, the area they drain, and their gradients. The article on Essex in the new edition of the

L'Ancienne Végétation Polaire ' (1877), or Professor Dyer's lecture in the Proceedings of the Royal Geographical Society for 1878. Of course Sir Joseph Hooker's valuable Address to the Geographical Section of the British Association at York was delivered subsequently to this lecture of mine.

'Encyclopædia Britannica' affords hardly any information on the natural features of the county, and the drainage is barely alluded to in Mr. Gibson's '*Flora of Essex*.'

I propose to divide the county into seven Sub-Provinces, viz.: 1, the *Lea and Stort*; 2, the *Roding*; 3, the *Crouch*; 4, the *Blackwater*; 5, the *Colne*; 6, the *Stour*; 7, the *Brook*. Of these the first two come within Province (A), that of the Thames and its tributaries. From the direction of its mouth and delta-deposits it seems that, were the sea-bed elevated, the Crouch, with its tributary the Roach, would unite with the Blackwater rather than with the Thames. I therefore class it in Province (B) East Anglia. The River Lea rises in the Chiltern Hills in Bedfordshire; flows south-east through Herts, the eastern two-thirds of which is drained by it and its tributaries, of which the Maran and the Beame are each about eleven miles in length. It then flows south to the Essex boundary near Roydon, where it receives the waters of the Stort, separates us from Herts down to a little below Waltham Cross, and then from Middlesex down to its outfall into the Thames at Bow Creek. Its total course is about fifty miles; but I have no information as to the acreage drained by it and its tributaries in Essex. The Stort rises within the Essex boundary between Little Chishall and Langley Mills, reaches the boundary between Stanstead Mountfitchet and Birchanger, and forms the boundary for the greater part of the remainder of its course to Roydon, receiving at Stanstead a stream (name?) from Chickney, giving its name to Bishop's Stortford, receiving the Pincey brook from Hatfield Forest near Harlow, and a Hertfordshire stream from the neighbourhood of Sawbridgeworth above Burnt Mill Station. Its total course is nineteen miles. Below Roydon the Lea receives the Cobbin River from between North Weald and Nasing, and from Middlesex Salmon's Brook from Enfield Chase and other streams from Hadley, East Barnet, Finchley, and Southgate, from Highgate and Hornsey (at Tottenham), and formerly the Hackney Brook at Old Ford. The Roding rises at Brook End near Easton, flows south by many villages to which it gives a name to Chipping Ongar, receiving a tributary

stream (name ?) from North Weald, then flows south-west to Chigwell and Woodford, and finally south-east past Ilford into the Thames at Barking Reach. Near Ilford it receives two streams from Hainault Forest, the upper of which seems to bear the name of Aldersbrook. The entire course of the Roding is stated by Gibson as 87 miles, and by the Ordnance Survey as 83 miles, the area it drains being 817 square miles.²¹ The Pym or Bourne rises at Stapleford, flows past Havering-atte-Bower, Romford, and Dagenham, into the Thames at Halfway Reach. Next come three streams of doubtful nomenclature. One flowing west of Upminster and Rainham is marked "Ingreburn" in the 'Encyclopædia Britannica'; the second flows from between North and South Ockendon to the east of Rainham; and the third flowing from Thorndon Hall to Stifford and Purfleet is marked Ingrebury in Mr. Gibson's map, but flows past a hamlet named Childerditch. The name Ingrebourne probably belongs to the last. The River Roach, made up of streams from Hadleigh and Prittlewell and from above Roehford, flows mainly between Foulness and Wallasea Islands. Its basin, with that of the Crouch, includes 181 square miles. The latter river rises near Little Burstled, less than three miles from the sources of the Childerditch stream and the Wid, a tributary of the Chelmer, and flows eastward, having a course of 15 miles. It is doubtful if the name Blackwater is properly applied to more than the estuary of the great series of streams which drain 484 square miles out of the 1648 which Essex contains. In accordance with this view, the Ordnance Survey gives it a length of only 6 miles, as against Mr. Gibson's 46. The stream which rises near Wimbish, and runs by Bardfield and Shalford to Panfield, ought, at least so far, to be known as the Pant.

According to the best local authorities the stream should not be called Blackwater until it reaches the village of that name, half-way between Coggeshall and Braintree. The Survey gives the length of the Pant as twenty-eight miles. Below Kelvedon Mill, the Blackwater receives a stream there known

²¹ [It may be remarked that the name of the river is always spelled "Rhodon" in Warner's 'Plantæ Woodfordienses.'—E.D.]

as Oyn's Brook. It rises north of the railway, in the parish of Feering, and is known as Domsey Brook until it enters East Thorpe. Thence it flows through Massing and Inworth to its confluence. Another small rivulet enters the Blackwater near here, on the same (left) bank. Rising on Tiptree Heath, in the parish of Messing, it flows north-west through Great Braxted and Inworth to the bridge below Gray's Mill, Kelvedon. At Rivenhall End another stream enters the Blackwater on the other side from Cressing. It is known as Cressing Brook, and lower down as Rivenhall Brook. Near Witham the Blackwater receives on its right bank a large tributary from Bardfield and Braintree. This is known as the Podsbroom, or below Braintree as the Brain, and, flowing past Black and White Notley, is inaccurately marked as the Blackwater in Mr. Gibson's map. The Blackwater enters the Chelmer navigation at Maldon. The Chelmer rises south of Debden, flows past Thaxted to Tittey, where it receives on the right bank a stream from between Chickney and the main source, to Dunmow, below which it receives a tributary from Lindsell and Stebbing, and so on to Chelmsford, where it receives the Cann. The Cann rises near Great Canfield and High Roothing, and flows past Good Easter and Chignal St. James to the Warren Farm, where it receives on its right bank a tributary (the name of which is unknown, but which might well be termed Roxwell Brook) that rises near Clerks, between Blackmore and Shellow, and flows through Roxwell. Nearer Chelmsford the Cann receives on its left bank a tiny stream from Brick Chignal, and on its right the important stream, the Wid. The Wid rises near Thorndon Hall, Brentwood, flows to Mountnessing, where it receives another stream partly from Navestock, and partly from Blackmore and Doddington (name ?), on to Margaretting, Widford, and its confluence with the Cann. The length of the Wid is stated at thirteen and that of the Cann at ten miles. Below Chelmsford the Chelmer receives, at Little Baddow, two affluents on opposite banks; on the north or left bank one from Holt's Chantry; on the south one from Preston, Haningfield and Sandon; and lower down the more important

River Ter. The Ter rises near Felstead, flows on to Fairstead, where it receives a stream from Black Notley, and to Terling, to which it gives a name, its course to its affluence being twelve miles. The entire length of the Chelmer to Maldon is stated by Gibson, probably accurately, as thirty-four, by the Survey as twenty-nine, miles. The estuary of the Blackwater receives four principal streams, two from the south from Woodham Mortimer and Haseleigh, and on the north one from the Tothams and the Lime Brook from the Tolleshunts.

The district south of the high road from Snoreham to Bradwell, drained by rivulets running to Danesey Flats, I consider as part of the valley of the Crouch; but the twenty-four square miles north of the river-mouth, classed apart by the Survey as "small streams," including Virley and Salcot Marsh, I group in the Blackwater Basin. Mersea Island falls most naturally, perhaps, into the Colne district. The Colne Basin includes 407 square miles, and the length of the river—which rises near Bumpstead and Birdbrook, and passes E.S.E. by Yeldham, Hedingham, and Halstead, to Colchester and Mersea Island—is thirty-six miles, according to Gibson, and, probably in fact, but only twenty-four according to the Survey. At Colne Engaine it receives, on its south or right bank, a stream from Weathersfield and Gorsfield, and lower down, on its left bank, one from Pebmarsh. Below Greenstead an affluent enters it from Several Hall, and above Fingrinhoe, opposite Wivenhoe, it receives the Roman River. This stream rises between Earl's Colne and Great Tey, and is first known as Tey Brook; flows past Aldham, where it is called Aldham Brook, to Stanway, below which it bears the name of Roman River, and near Abberton receives the Layer Brook from above Layer Marney. The fifty-three square miles between Colchester and Walton mapped by the Survey as drained by such streams as those from Bromley and Bentley, and the Holland Creek, I place in the Colne sub-province; but the neighbourhood of Oakley and Wicks belongs to the Stour drainage.

This latter river rises in the south-west of Suffolk, on the

Cambridgeshire border, and flows eastward to Wixoe, where it begins to form the boundary between Suffolk and Essex. Its drainage-area is variously stated at 430 or 407 square miles, most of which is in Suffolk, and its length as 45 or 55 miles: probably the smaller number is the true one in each case. Its chief tributaries are the Suffolk rivers, Brett, Boxford, and Orwell, but from Essex it receives four small streams: one above Sudbury, from Ovington, Wickham St. Paul, and Belchamp Water; another below Bures, from Pebmarsh; a third at Neyland, from West Wood Green; and, below Langham, one from Boxted Heath.

In the seventh and last sub-province, the Brook rises between Debden and Ugley, and flows northward, receiving the water from Debden Lake, through Quendon, Newport (where it receives a stream from Arkesdon), Wendon (where it receives another, also on its left bank, from Chishall and Wendon Lofts), and Audley End, where it receives the Slade, to Chesterford, where it leaves the county. The Slade rises between Hadstock and Little Chesterford, and flows under the town of Saffron Walden. The Brook is a tributary of the Cam or Granta, and is spoken of by both these names. Probably Granta is merely a scholastic form of the name Cam, as Isis has been coined at the sister University. The main stream of the Cam rising in North Hertfordshire is sometimes termed the Rhee. The question as to which of these sources and streams is the main river is, like that between the Churn and the Thames Head Brook, one of no real importance or possible solution. Such being the principal watercourses of the county, my sub-provinces depend upon their watersheds, as follows:—

Sub-province 1—Lea and Stort. From 7, by line from Little Chishall to Langley, Rickling, Ugley, and Henham-on-the-Hill; from 2 and 4, by this line continued to Broxted, Little Canfield, White Roding, High Laver, North Weald, Epping, High Beach, Walthamstow, Wanstead, East Ham, and North Woolwich.

Sub-province 2—Roding and Small Thames affluents. From 4, by line from Broxted, through Easton Park to High Easter,

Good Easter, Shellow Bowells, Stondon Massey, Navestock, South Weald, Brentwood, and Thorndon Hall; and from 8, by this line continued to Langdon Hills, Vange, and along the high road to the river at Southend, including Canvey Island.

Sub-province 8—Crouch. From 4, by a line from Herongate, Thorndon Hall, to Billericay, Downham Green, Hillhouse, Woodham Ferrers, Norton Cold, and along the high road to St. Peter's Church, Bradwell.

Sub-province 4—Blackwater. From 7, by a line from Henham-on-the-Hill to Debden and the county boundary near Cut Bush, Ashdon. From 5 and 6, by a line from Bumpstead to Weathersfield, High Garret, Marks Hall, Little Tey, Messing, Inworth, Primrose Hill, Tolleshunt Knights, Hyde Farm, Great and Little Wigborough.

Sub-province 5—Colne. From 6, by a line from Broad Green, Bumpstead, to Ridgwell, Little Yeldham, Crouch House, Catley Green, Garlands, Counters Cross, Highfield, West Wood Green, Ardleigh, Bradfield House, Wicks Cross, Stone Cross, and Great Oakley.

Sub-province 6—Stour, and Sub-province 7—Brook, are thus already defined.

As compared with Mr. Gibson's divisions, my sub-province 1 comes in his 1, 3, and 4; my 2 in his 1 (very little), 3, 4, and 5; my 3 in his 5 and 6; my 4 in his 1, 2, 3, 5, 6, and 7; my 5 in his 1 (very little), 2, 7, and 8; my 6 in his 1, 2, and 3; and my 7 entirely in his 1.

Thus, making another much urged alteration, *viz.*, substituting abbreviated names for initials, Mr. Gibson's localities for *Clematis Vitalba* will run, when re-arranged, as follows:—

1 ?—2. Little Warley, *Hind*. Tilbury, *Newb*. Southend, *Ibbot*. Romford, *Ibbot*.—3. Rochford, *Ibbot*.—4. Chelmsford, Broomfield, Boreham, *Pigg*. Kelvedon, Rivenhall, *Varen*. Maldon, *Ibbot*.—5. Halstead, *Bent*. Copford, *Bab*. Colchester, *Garn*.—6 ?—7. Common in the Walden district, *Gibs*.

To recast the whole of this valuable work in the manner thus proposed would be a labour of considerable difficulty.

In conclusion, I have to acknowledge my indebtedness to R. M. Christy, Esq., of Saffron Walden, and E. G. Varenne, Esq., of Kelvedon, for many valuable local corrections. I have thought it useful to append a table of the rivers and their tributaries, giving lengths where known. R. = entering on right bank; L. on left. [] square brackets signify that the stream is not in Essex. " " inverted commas denote provisional names.

LEA. 50 miles.

[R. Maran. 11 m.]

[R. Beame. 11 m.]

L. STORT. 19 miles.

L. "Chickney Brook."

L. Pincey Brook.

[R. "Sawbridgeworth Brook."]

L. Cobbin River.

[R. Salmon's River.]

[R. "Hadley Brook."]

[R. "Hornsey Brook."]

[R. Hackney Brook.]

RODING. 83 miles.

R. "North Weald Brook."

L. Aldersbrook.

L. "Ilford Brook."

PYM OR BOYRNE.

"UPMINSTER BROOK."

"RAINHAM BROOK."

INGREBOURNE.

CROUCH. 15 miles.

R. Roach.

CHELMER. 84 miles.

R. "Tittey Brook."

L. "Lindsell Brook."

R. CANN. 10 miles.

R. "Roxwell Brook."

L. "Brick Chignal Brook."

R. WID. 18 miles.

L. "Doddinghurst Brook."

- L. "Holt's Chantry Brook."
- R. "Haningfield Brook."
- L. TER. 12 miles.
 - L. "Fairstead Brook."
- L. BLACKWATER OR PANT. 28 miles.
 - L. Oyn's or Domsey Brook.
 - L. "Tiptree Brook."
 - R. Rivenhall or Cressing Brook.
 - R. Brain or Podsbrook.
- R. "Woodham Mortimer Brook."
- R. "Haseleigh Brook."
- L. "Totham Brook."
- L. Lime Brook.
- COLNE. 86 miles.
 - R. "Gosfield Brook."
 - L. "Pebmarsh Brook."
 - L. "Greenstead Brook."
 - R. ROMAN RIVER, TAY, OR ALDHAM BROOK.
 - R. Layer Brook.
- STOUR. 45 miles.
 - R. "Belchamp Water."
 - R. "Bures Brook."
 - R. "Nayland Brook."
 - [L. Brett. 17 m.]
 - [L. Boxford.]
 - [L. Orwell and Gipping. 82 m.]
- BROOK OR GRANTA.
 - L. "Arkesdon Brook."
 - L. "Wendon Brook."
 - R. Slade.

Addenda and Corrigenda to p. 80.—Line 18, after "Bedfordshire" add "in Seagrave Marsh, near Dunstable"; l. 17, after "Roydon" add "and Hoddesdon"; l. 20, after "fifty" add "five"; l. 28, after "Mills" add "near Clavering"; l. 2 from bottom, after "Easton" add "above Little Canfield."

**XII. ON THE LAND AND FRESH-WATER MOLLUSCA OF THE
DISTRICT AROUND COLCHESTER; A CONTRIBUTION TOWARDS
A LIST OF THE FAUNA OF ESSEX.**

By **HENRY LAVER, M.R.C.S., F.L.S.**

[Read September 24th, 1881.]

THE distribution of the Mollusca of a district depends so much on its geological features that no excuse is needed in prefacing an account of the Conchology of Colchester by giving its geological conditions. The town itself, south of the River Colne, is situated on sands and gravels, and the same soil is continued for five miles from that river in the southerly district, and also for four miles to the west of the town, as well as for two miles on the east. Beyond this distance, in the latter direction, there are clays, sands, and gravels of the Tertiary formations. Southwards the sands and gravels are succeeded by London Clay, and westwards by Boulder Clay and Brick Earths, as at Copford, where are the well-known brick pits and the remarkable deposit of Shell Marl. North of the town, after crossing the river valley, London Clay appears again, and continues until the Stour is approached, when sand is the prevalent formation.

From this short sketch it will be seen that geologically the district is one from which many molluscan forms will be wanting. There is an entire absence of bog, and on the whole the district may be considered dry; but it is fairly timbered, and contains a few woods, principally composed of oak. The greater part is under the plough, and there are no commons worth mentioning. With all these unfavourable conditions, I think the following list will prove that we are richer in species than might have been expected.¹

¹ [The number of species enumerated by Mr. Laver within his district is 75, compared with 121 species given by Jeffreys in 'British Conchology' as the total number of Land and Fresh-water Molluscs at present inhabiting Great Britain.—ED.]

The Colchester district is watered by three rivers, the Colne and Blackwater wholly in Essex, and the Stour dividing this county from Suffolk. Its boundaries are a line drawn from Bures, through Coggeshall to Maldon, on the west side, and on the east, south, and north the sea and rivers form its confines.

The names and arrangement adopted in the paper are in accordance with Mr. J. Gwyn Jeffreys' 'British Conchology.'

SPHÆRIIDÆ.

SPHÆRIUM CORNEUM, Linn.—As is usually the case, this is abundant in all the streams and ponds which are suitable. I find it most variable, but I cannot satisfy myself that we possess more than one of the varieties named by Jeffreys.

Var. *flavescens* occurs in the most rapid parts of a brook two miles south of the town.

S. LACUSTRE, Müll.—Occurs in many ponds, on gravel as well as clay, and it is surprising how they manage to exist in the stagnant and filthy water of some ponds.

Var. *Brochoniana*.—This form I find in the remains of the moat of an old manor house at Birch, on Boulder Clay.

PISIDIUM AMNICUM, Müll.—Although usually so common, I cannot say that I find it abundantly; perhaps I have not the knack of searching for it.

P. FONTINALE, Drap.—In the marshes of the Colne, &c., but not abundantly. I do not think we have any of the named varieties, but I find the shell to be very variable.

P. FUSILLUM, Gmelin.—Very abundant in shallow roadside ditches which are dry for months at a time. This also is a variable species, some specimens being nearly round, *i.e.*, more ventricose than usual.

P. NITIDUM, Jen.—I do not find it abundant, but still the river meadows generally seem to have some in most of the ditches at one part or other. The long grasses growing in

* 'British Conchology, or an account of the Mollusca which now inhabit the British Isles and the surrounding seas.' Vol. i. Land and Fresh-water Shells. London, 1862.

the water beside the drinking-places for cattle I find most productive.

I consider this to be a most unsatisfactory family, and question very much whether it will not be necessary to reduce the number of species to three, and call the others varieties.

UNIONIDÆ.

UNIO PICTURUM, Linn.—I have seen shells of this species from the river at Coggeshall, but I have never taken it myself. They were the ordinary form, and I do not think it occurs elsewhere within my boundaries.

ANODONTA CYGNEA, Linn.—In every stream and many ponds.

Var. *radiata*.—In almost stagnant ponds; at Bromley Lodge very large specimens occur, but I think the shells are thinner than in the normal form.

A. ANATINA, Linn., appears to me to be only a variety of the above. The intermediate forms are many, and I think it is only a question of food. I have stocked a suitable pond with *anatina*, and hope one day to note the result.

NERITIDÆ.

NERITINA FLUVIATILIS, Linn.—Plentifully on stones in all our streams. The markings are very varied.

PALUDINIDÆ.

PALUDINA CONTECTA, Millet.—In the Stour the specimens are very large, but I do not find it to be an inhabitant of any other stream.

BYTHINIA TENTACULATA, Linn.—Very frequent in both running and still waters. The most abundant fossil at Copford.

B. LEACHII, Shepp.—Occurs in the same habitats as the last species, but is much less abundant.

VALVATIDÆ.

VALVATA PISCINALIS, Müll.—Frequent in all our streams, and in the fossil state at Copford in great plenty.

V. CRISTATA, Müll.—I find this species is more frequently an inhabitant of ponds than *V. piscinalis*. It occurs everywhere throughout the district, and is one of the shells chosen frequently by a Caddis-worm to form its case.

LIMNÆIDÆ.

PLANORBIS LINEATUS, Walker.—I have seen shells said to have been found in the Stour within my boundaries, but have never taken the species myself.

P. NITIDUS, Müll.—Occurs in many parts of the district both in slow streams and ponds, but it is not frequent.

P. NAUTILEUS, Linn.—No doubt is frequently passed over from its small size. I find it sometimes very abundantly in ponds at West Bergholt. *Var. cristata* occurs in the same spots, and is, I think, one of our most beautiful shells.

P. ALBUS, Müll.—Abundant where it occurs, but occasionally for years it seems almost to die out in some ponds. It is found on all soils: also in brackish water on the marshes near Wyvenhoe Park.

P. SPIROBIS, Müll.—Very abundant. I have found several distorted specimens in which the whorls are more or less separated or displaced.

P. VORTEX, Linn.—Not quite so abundant as the last species, but found all over the district.

Var. compressa.—Occasionally in the marshes of the Colne.

P. CARINATUS, Müll.—I find this snail more frequently in the marshes by the rivers and brooks than in stagnant ponds. It is said never to be plentiful, but I once found a shallow pond near Ardleigh Crown swarming with it.

P. COMPLANATUS, Linn.—Common throughout the district.

P. CORNEUS, Linn.—I never find this mollusk in ponds unless they are in the marshes and connected with the rivers; there they are fairly plentiful. The largest specimens I have seen were reared in a soft-water butt, at Wormingford.

P. CONTORTUS, Linn.—Common in our rivers and ponds of stagnant water in many parts of the district.

PHYSA HYPNORUM, Linn.—Very local and rare. An occasional

one may be found in the Colne. In a ditch running into this river near Sheep-pen Bridge at times it is very plentiful; but often for months this ditch is dried up, and then I do not know where to find the snails.

P. FONTINALIS, Linn.—Frequent in all the brooks and streams.

LIMNÆA PEREGRINA, Müll.—Everywhere.

Var. *ovata*.—I have never found this form except in the Colne and Stour. Some specimens are very large and not unlike *L. auricularia*.

Var. *acuminata*.—I find this also in the same localities as the last.

Var. *maritima*.—Occurs in considerable numbers in the brackish, almost salt, water of the ditches near Wyvenhoe Park, in company with *P. albus*.

Var. *scalariformis*.—Frequent in the small drains of one meadow near Birch Hall. There are all the intermediate stages between the normal forms and those in which the whorls of the shell are nearly separated.

L. AURICULARIA, Linn.—In the Stour and also in the Colne, but the intermediate forms between *L. peregrina* and this species make it at times difficult to decide to which the varieties belong.

L. STAGNALIS, Linn.—Frequent in the Stour, and especially so in some years; also in ponds in many parts of the district where clay occurs. I never find it on gravel. In some ponds at Wormingford the shells are quite two inches long.

L. PALUSTRIS, Müll.—Frequent in ponds on all soils.

L. TRUNCATULA, Müll.—Common everywhere. It is difficult to understand how this snail exists in shallow roadside puddles which are dry during months in the year. These situations generally produce:—

Var. *minor*.—Commonly.

Var. *major*.—I have found this form in a pond near Bottle End, Stanway, which is never dry, in company with *L. palustris*.

L. GLABRA, Müll.—Ditches and shallow ponds, abundantly; especially on gravelly soils. I once found it in a wet spot in

Donyland Wood, where the spring scarcely gave enough water to cover the shell. This is one of the molluscs which aestivates early, very frequently disappearing early in March.

ANCYLUS FLUVIATILIS, Müll.—I have only found this mollusc in the stream near Kingsford, Stanway, and there sparingly, adhering to stones.

A. LACUSTRIS, Linn.—Frequent in the Stour and Colne on water-lilies and other plants. The dead shells are very numerous in the Stour at Wormingford, and are also plentiful at Copford in the classic Shell Marl.

LIMACIDÆ.

ARION ATER, Linn.—Common everywhere.

A. HORTENSIS, Linn.—Common everywhere.

LIMAX FLAVUS, Linn.—Common everywhere.

L. AGRISTIS, Linn.—A common pest.

L. MAXIMUS, Linn.—Frequent in ashpits in the town, as well as commonly in woods and damp places.

HELICIDÆ.

SUCCINEA PUTRIS, Linn.—Frequent in wet spots by the rivers and brooks. In the water-furrows of the meadows near New Bridge, I find a very small variety, with a shell, in proportion to its size, thicker than usual; this may be Var. *subglobosa*, Jeffreys. It has one peculiar habit, being rarely found otherwise than submerged. In the spots where I find this variety, I never find the normal form.

S. ELEGANS, Risso.—Common on duckweed in the ditches of the meadows close to the town; its blackness makes it very prominent.

VITRINA PELLUCIDA, Müll.—Frequent under stones, wood, or anything which retains moisture, the dead shells being much more numerous than living ones.

ZONITES CELLARIUS, Müll.—Frequent in suitable spots. I have found it in damp places at the foot of the cliffs at Walton-on-the-Naze, of a dark horn colour; but in some cellars at Shrub End, near Colchester, the shells are very large, flat, and almost white in colour.

Z. ALLIARIUS, Miller.—Very common under fallen timber in woods.

Z. GLABRA, Studer (*Z. alliarius*, Miller).—In similar spots to the last species. Not rare.

Z. NITIDULUS, Drap.—Everywhere in moss, damp herbage and dead leaves. I also find it commonly in the loose soil under leaves in woods.

Z. PURUS, Ald.—The like localities produce also this species, but not so commonly as the last, and I never find the shells so nearly white as some I have had sent me.

Z. RADIATULUS, Ald.—I find this species and other small shells by sifting the leaves and rubbish from the damp places of our woods, in a brisk current of wind. By repeating the process again and again, I have at last but a small quantity of rubbish to spread on white paper and search over, and I find this species to be not nearly so rare as is generally supposed.

Z. NITIDUS, Müll.—Rare, but easily distinguished by the dark colour of the snail when living. Found occasionally under moss and damp herbage.

Z. CRYSTALLINUS, Müll.—Frequent in wet moss and under dead leaves in all suitable places. Found by searching and winnowing as above described.

Z. FULVUS, Müll.—Very common under leaves in woods.

Suitable damp spots seem equally productive of this genus in this district, whether the soil be clay, gravel or sand. I have not therefore stated the soil on which I have found individual species.

HELIX ACULEATA, Müll.—Very rare. I did not think it occurred until I adopted the winnowing process.

H. ASPERSA, Müll.—Extremely abundant everywhere. I cannot recognize any of Jeffreys' varieties, but in Trinity Churchyard, opposite my house in the centre of this town, we often find an albino aberration.

H. NEMORALIS, Linn., and **H. HORTENSIS**, Müll.—Both very common, and as they are usually considered to be simply varieties I give them together, but I generally find where one is abundant the other is scarce, and I very much question whether they are not distinct species.

H. ARBUSTORUM, Linn.—Not rare, but very local.

H. CANTIANA, Mont.—Very common, especially on the gravel.

H. CONCINNA, Jeffr.—Abundant on the Roman wall and elsewhere, in suitable spots throughout the district.

H. HISPIDA, Linn.—Common.

H. VIRGATA, Da Costa.—Abundant on the coast at Walton and Clacton, on the cliffs of London Clay. Found also inland, on gravel and sandy soils, but local. At Paglesham near Rochford, on clay, (but this is beyond my district), I have seen the vegetation absolutely swarming with this species and *H. caperata*. It is there very large, and many of these large shells have scarcely any markings.

H. CAPERATA, Mont.—Common, but local.

H. ERICETORUM, Müll.—I have never found this species except by the side of the brook at Marks Tey, where the subsoil is boulder clay.

H. ROTUNDATA, Müll.—Abundant in woods under fallen timber, bark, leaves, &c.

Var. *alba*.—Rare.

H. PULCHELLA, Müll.—Not rare in damp spots in pasture in all parts of the district.

Var. *costata*.—I find this form on the Roman wall surrounding the town.

H. LAPICIDA, Linn.—I have no doubt this snail occurs in the district, as I once found a dead shell at Layer de la Hay, and I know it occurs at Wiston, on the Suffolk side of the Stour, on a sandy subsoil.

BULIMUS OBSCURUS, Müll.—Rare. I find an occasional shell in the hedges.

PUPA UMBILICATA, Drap.—Frequent on the Roman wall and on Colchester Castle, and very rarely on trees.

P. MARGINATA, Drap.—About as common as the last on the castle and wall; rare elsewhere according to my experience, but the Rev. Revett Sheppard says it occurs in profusion near Wrabness Point, in the Stour estuary, a situation which at high tides is covered with water.

The above two forms are the only species of the genus *Pupa* that I have been able to find or hear of as occurring in

the district, and no species of *Vertigo* has been recorded. Some species exist in all probability, but none of my friends who have searched for shells have found them, nor have I been more fortunate, although in other parts of the country I have experienced no difficulty in detecting *Vertigos* when inhabiting the locality.

BALIA PERVERSA, Linn.—I found this snail once, commonly, under the bark of a dead poplar, near the Decoy, West Mersea, and this is the only situation in which I know of its occurrence.

CLAUSILIA RUGOSA, Drap.—Locally abundant, and occurring in many parts of my district sparingly. I think they are most frequent on the Boulder Clay formation. I have not recognized any of the named varieties.

COCHLICOPA TRIDENS, Pult.—I have no doubt this occurs, although I have never found it. It occurs sparingly at Wiston, on the Suffolk side of the Stour.

C. LUBRICA, Müll.—Frequent in all parts of the district, but I have not been able to distinguish any of the named varieties.

ACHATINA ACICULA, Müll.—I have never met with the living snail, but dead shells are found in all parts of the district. It is said to occur only on calcareous soils, but I find the shells most frequently in the sandy and gravelly soil around the town. In the rubbish and growing sods of grass on the Roman wall it is frequently noticed, and some years since a Roman cloaca near the castle was opened, and in the soil at the bottom of the drain this shell occurred in thousands. There is one way to find it that I have never seen mentioned. It is to search the tops of the hills of the small ants in the open fields, on any soil, and amongst the earth the insects bring up the shells may generally be found, frequently washed clean by the rain which has percolated the soil.

CARYCHIDÆ.

CARYCHIUM MINIMUM, Müll.—Common everywhere in damp spots in meadows, hedges and woods. Easily found by employing the winnowing process.

The above list is as complete as I have been able to make it. Of course there are portions of the district that I have not explored, as my engagements have prevented me making long excursions; but as far as I have gone I think I have searched over the ground somewhat minutely and carefully. It will no doubt be remarked that there is almost an entire absence of species of the genera *Pupa*, *Vertigo*, and *Clausilia* in my catalogue. I suppose this fact may be accounted for by the deficiency of calcareous strata in the district. All the names of shells which appear in the list are inserted after a personal examination of the specimens and localities, and may be relied upon. I have carefully verified every shell named, and to insure correctness in doubtful cases I have had my opinion confirmed by some of the best authorities.

I cannot leave this subject without calling attention to an extraordinary deposit of land and fresh-water shells, in a fossil condition, in the brickyards at Copford. This Shell Marl was fully described by the late John Brown, F.G.S., in the 'Journal of the Geological Society of London' for August 1852, vol. viii., p. 184. He shows that more than sixty-nine species are there represented, only two of which (*Helix incarnata* and *H. ruderata*) are extinct in this country.

From a personal examination I can testify to the number of *Vertigos*, both as regards species and individuals, as well as other rare shells, contained in this deposit.

XIII. THE GALLS OF ESSEX; A CONTRIBUTION TO A LIST OF THE INSECT FAUNA OF THE COUNTY.

By EDWARD A. FITCH, F.L.S., Sec. Ent. Soc., &c.,
VICE-PRESIDENT.

[Read October 29th, 1881.]

A GALL may be defined as an abnormal or morbid growth, due to parenchymatous hypertrophy, and produced by the peculiar action of some unnatural or foreign agency, probably through mechanical irritation. These growths occur both in the animal and vegetable kingdoms. Animal galls are not common, unless we include the various inflammatory growths and excessive developments of cuticle so common in the Mammalia, which are gall-like in nature, although not true galls. Animal galls caused by insects, however, occur in the peculiar "worbles" or "bots" often so commonly seen on the backs of our young cattle; these are produced by a dipterous fly (*Estrus bovis*, Linn.), which lays its eggs under the skin of the bullock, and the inflammation set up produces a gall in which the larva resides until full-fed.¹ This is hardly a true gall, as there is a small orifice communicating with the open air, but still it is as analogous as the exigencies of animal and vegetable pathology will allow. Animal pseudo-galls have also been produced by the action of various Acaridea. Much of interest might be said about these and other pseudo-galls; but our business is with the vegetable galls more particularly, and to these we will turn.

Plant galls are fairly ubiquitous, and some kinds must be known at least by sight to everyone; these distinct abnormal growths have been noticed by all naturalists or general observers in one form or another, especially the galls occurring on various trees, as the oak, willow, elm, or rose.

¹ Many similar swellings are produced on various animals by the *Estridae*. Cf. F. Brauer's 'Monographie der *Estriden*.' Vienna, 1863.

Galls are known to occur on plants in nearly every order of the vegetable kingdom; they vary greatly in their form and in their situation on the plant. This will be fully exemplified presently, when I shall come to a detailed examination of our Essex gall fauna.

More strictly speaking, the term "gall" is applied to an abnormal vegetable growth. Lacaze Duthiers defines "galls" as comprising "all abnormal vegetable productions developed on plants by the action of animals, more particularly by insects, whatever may be their form, size, or situation."¹ This is by no means a scientific definition, but the limitation is convenient and the intention is apparent. It must, however, be remembered that all abnormal vegetable growths are not galls, as will readily be seen from a study of Dr. Masters's 'Vegetable Teratology.'²

This brings us to a starting point—the cause of galls. A gall is an abnormal vegetable growth produced through the internal action of some foreign agency. This agency is generally either the influence of a fungus or of some Arthropod. Certain of the Anguillulidæ,³ belonging to the Nematode worms, and some Infusoria (*Vibrio*, &c.), are also gall-makers, and possibly even certain Rotifera. Both the animal and the vegetable causative actions produce often remarkably similar inflammatory and stimulated growths, and most frequently these are abundantly distinct from any normal production or growth of the galled object.

So far the subject is clear, but the exact way in which the foreign influence is brought to bear on the vegetable growth is still matter for conjecture and experiment. The actual progressive structure of the gall itself also still affords a good working field for the structural botanist.

The "gallic" force of an insect, so to speak, is vulgarly

¹ 'Annales des Sciences naturelles.' Botanique. 3rd series, vol. xix., p. 273. Paris, 1853.

² 'Vegetable Teratology.' By Maxwell T. Masters, M.D., F.L.S. London (Ray Society), 1869.

³ 'Monograph on the Anguillulidæ.' By H. Charlton Bastian, M.A., M.B. Transactions of the Linnean Society, vol. xxv., pp. 73—184, pls. 9—13. (1866).

supposed to consist of some acid injection into the plant-tissues, at the time of oviposition, by the parent insect. It may well be thought that the Cynipidæ sting plants in a way similar to that in which the Aculeate Hymenoptera (ants, bees, wasps, &c.) operate upon animals, and which is so often painfully patent to ourselves; even the gall-gnats (Cecidomyidæ) may be similarly accredited with a kind of stinging power without much stretch of imagination, when reasoning from analogies. But we can hardly suppose many of these growths to be due to the stings of the various moths, beetles, plant-lice (Aphides), bugs, and especially mites, which are known to produce them. Scientifically also, the theory of a special "gallic" poison injected by the mother gall-maker cannot stand. I am sorry to see that Sir James Paget should foster this opinion, when he remarks:—"We find hundreds of different forms of galls, and we may be nearly sure that there are as many kinds of morbid poisons produced by the gall-insects, each form answering to a different virus."⁵ Mr. G. B. Buckton also writes, "It may be noted that the injection of acrid or other juices into living vegetable tissue by Hemiptera and other insects produces on plants phenonema very similar to inflammation in animal organisms. Vessels become turgid, cell-walls become thickened, and abnormal growths (in vegetables often elegant instead of monstrous) take the place of simple structures."⁶

In a paper read before the Linnean Society on January 21st, 1875, Dr. W. Ainslie Hollis fully examined the question of the causative formation of galls. To this memoir I am indebted for some of the following views and opinions of the older writers.

Zoology and Botany as sciences may reasonably be said to commence with Linné. It will be quite useless to examine further back, although folk-lore is very entertaining and the

⁵ 'An Address on Elemental Pathology, delivered in the Pathological Section of the British Medical Association, at the annual meeting in Cambridge, August, 1880.' By Sir James Paget. P. 23. London, 1880. Also the 'Lancet,' October 23rd, 1880, p. 646.

⁶ 'Monograph of the British Aphides.' By George Bowdler Buckton, F.R.S., F.L.S., &c. London (Ray Society), vol. iii., p. 85; 1881.

folk-lore of galls would yield a goodly chapter, but with little help towards the present enquiry.[†] Compare the well-known remarks of many classical writers, and some curious information given in Kirby and Spence's 'Introduction to Entomology.'

Linné tells us the insect punctures the plant, and the out-flow of sap from the wound is the cause of the formation of the gall. "*Cynipes succo plantarum e vulnere inflicto stillante et in gallam in qua habitant larvæ excrecente viciant.*" [Gmelin's Linné, 'Syst. Nat.,' vol. i., pars. v., p. 2650.]. De Geer, Réaumur, Roesel, Frisch, Malpighi, and others had previously promulgated this convenient but thoroughly untenable theory; still this was generally accepted to the days of our own Kirby and Spence.

These fathers of British Entomology epitomized the information on this puzzling subject thus:—"How the mere insertion of an egg into the substance of a leaf or twig, even if accompanied, as some imagine, by a peculiar fluid, should cause the growth of such singular protuberances around it, philosophers are as little able to explain as why the insertion of a particle of variolous matter into a child's arm should cover it with pustules of small-pox. In both cases the effects seem to proceed from some action of the foreign substance upon the secreting vessels of the animal or vegetable; but of the nature of this action we know nothing. This much is ascertained by the observations of Réaumur and Malpighi—that the production of the gall, which, however large, attains its full size in a day or two, is caused by the egg or some accompanying fluid,—not by the larva, which does not appear until the gall is fully formed; that the galls which spring from *leaves* almost constantly take their origin from nerves; and that the egg, at the same time that it causes the growth of the gall, itself derives nourishment from the substance

[†] References to fossil galls and some antiquated information occur in Mr. Albert Muller's memoir, 'In Memoriam Wilson Armistead, of Virginia House, Leeds.' 'Zoologist,' 2nd ser., vol. iii., pp. 1196—1206; May, 1868.

^{*} 'An Introduction to Entomology.' By William Kirby and William Spence. 4th ed. (1822), vol. i., p. 450; 5th ed. (1828), vol. i., p. 448.

that surrounds it, becoming considerably larger before it is hatched than it was when first deposited. When chemically analysed, galls are found to contain only the same principles as the plant from which they spring, but in a more concentrated state."

Hartig, in his specially scientific memoirs on the cynipideous gall-makers, treats somewhat lengthily on the physiology of the gall insects themselves, but on the growth of their productions he says but little, limiting himself strictly to the facts observed. He merely states, "The gall-flies are divisible into three groups, according to their mode of life. To the first of these belong those species which live some on the plant-juices and some on the cellular tissue and cork (starchy portions). These alone produce, through their oviposition in certain plants and parts of plants, an hypertrophy of the part from the usual form, and shape the plant-substance into a larva-house, the inner structure and outer form of which is dependent on the producing species of gall-fly. Every true gall-producing gall-fly has its own special form of gall, which is constant within certain limits; and we never find two similar species of true gall-fly inhabiting different formed galls, nor do we breed from similarly formed galls different species of gall-flies of the first group, which I therefore call *Psenides*."⁹

To come to the more feasible theory, as expounded by Dr. Hollis, we find that Van der Hoeven started on what may be considered the right road, when, after speaking of the deposition of the egg by the female *Cynips*, he says, "The irritation thus produced causes the sap to flow in greater abundance to the wounded part."¹⁰ Dr. Johnston, of Berwick, marked a still clearer line when he tells us, "We observe that the irritation caused by the deposition and evolution of the egg will produce growth of the most curious kind, and differences in the irritation, too slight to be traced, will occasion very remarkable differences in the appearance of

⁹ Translated from Germar's '*Zeitschrift für die Entomologie*,' vol. iii. p. 322. Leipzig, 1841.

¹⁰ '*Handbook of Zoology*,' translated by Clark, 1856, i. 384.

the growth."¹¹ Hofmeister observed the same principle when he maintained that the growth of the gall is due to the fact that it encloses an active living grub;¹² but he has overlooked those very obvious circumstances in which we find the galls fairly formed and often well grown before the larva-state of their legitimate inhabitants is reached. Here we fall back on Hartig, who had already clearly demonstrated the absolute growth of the curious pedunculate eggs of the Cynipidæ and other terebrant Hymenoptera.¹³ Dr. Hollis gave a quotation from Guibourt, which I here include,¹⁴ relative to the commensalism between the active life of the gall and of the gall-maker; and then continues, "With some reservation I accept the theories of Hofmeister and Guibourt, with regard to the origin and growth of the gall-nut, but I must introduce a third element into their formation, which appears to have been somewhat overlooked by these writers, and that is, the active growth of the plant itself."¹⁵ This all-important element had probably been understood, still it needs enunciation. It is most certainly a fact that a gall is never produced, except on those parts of a plant which are in active growth and in full receipt of the sap-flow. It may also, I think, be taken as a fact that the more active the

¹¹ 'Flora of Berwick-upon-Tweed,' ii. 106.

¹² 'Die Lehre von der Pflanzenzelle,' p. 634. (Leipzig, 1867).

¹³ 'Wiegmann's 'Archiv für Naturgeschichte,' iii., p. 151, pl. iv., 1837. Germar's 'Zeitschrift für die Entomologie,' ii., p. 179 (1840), and iii., p. 327, pl. i., figs. 5, 6 (1841). Also consult 'Over de Legboor van Aphilothrix radialis, Fabr.' By Dr. M. W. Beijerinck, in the 'Tijdschrift voor Entomologie,' vol. xx., pp. 186—198, plates 11 and 12; 1876—7.

¹⁴ "Une autre observation qui est commune aux autres galles, c'est que tant que l'insect y est enfermé, la galle du chêne tauzin offre une couleur rougeâtre et verdâtre, et une surface luisante qui indiquent qu'elle participe à la vie de l'animal; tandis qu'après sa sortie, elle prend une couleur terne et grisâtre et semble mourir." 'Histoire naturelle des Drogues simples,' 1849; ii., 278.

¹⁵ In a note on insect gall buds, Mr. A. Stephen Wilson, of Aberdeen, under date May 15th, 1879, thus writes to 'Nature' (vol. xx., p. 55):—"The insertion of the ovipositor brings a medullary ray into action, producing a tuberculated bud, and it is only the bud which the larva feeds upon. The growth of a bud is an intelligible cause of the growth of a gall, but we can infer nothing from the injection of a fluid."

growth of the normal organ affected by the gall the more short-lived the abnormal formation. In other words, the most quickly matured species of galls are always on the short-lived organs of reproduction rather than on the slow-growing organs of vegetation. For instance, in the oak, compare the catkin galls with the root and stem galls—the growth of *Spathogaster baccarum* galls with those of *Aphilothrix Sieboldi*, for instance. In the galls of *S. baccarum* I have also noticed that the growth is quicker in the catkin form than in the leaf form; the spring bud galls (e. g., *Spathogaster aprilinus*, *Aphilothrix albopunctata*, &c.) grow and mature much faster than the autumn galls (*Aphilothrix globuli*, *Andricus gemmæ*, &c.).

In the galls of the Cynipidæ we thus know that, soon after the deposition of the egg, active animal growth commences; this immediately sets up irritation of the plant-tissues, and according to the subtle specific character of the irritation and the nature of the part of the plant acted upon, the particular morbid or hypertrophied growth is produced and is maintained by an increased influx of nutritive material. This growth, however, only continues during the active life of the tenant; for as soon as the irritation ceases, apparently the vegetal growth also stops. This is quite analogous to the action of certain special irritants and the diagnoses of certain inflammatory actions in causing œdematous swellings in animal organisms, the different effects and nature of each being well known; as with the multifarious forms of galls the cause and effect are patent, but the subtle differences occasioning such constant but diversified results are untraceable. In the animal kingdom, hypertrophy or thickening of the cuticle is known to occur as the result of continued pressure to any part; but a less pronounced form of hypertrophy of cuticle is seen in the various forms of warts, where pressure is not an immediate agency in their production. I believe no intelligible explanation of the cause of warts and similar excrescences in the animal kingdom can be given; it is so with the vegetable galls, but in this kingdom we well know that the growth of the cambium tissue, &c., is accelerated

before the removal of pressure, as in the case of plant-cuttings, the growth of trees, &c. Gall-growth may be similarly affected by the removal of pressure through the puncture made by certain gall-producers, and in obvious other ways.

Sir James Paget has recently followed up Dr. Hollis's suggestions in enunciating the importance of the comparative pathology of oak-galls, in the remarkable address before quoted. I cannot forbear giving his valuable remarks relative to gall pathology *in extenso*, with the hope that some of our members may be led to take up this interesting study, which so closely affects both animal and vegetable physiologists. These were his words:—

“Of all morbid processes in plants, none, I think, are so suggestive as are those produced by parasites, whether vegetable or animal. The whole subject would be far too large to speak of, even if I were familiar with it; it is, indeed, a subject of the gravest national importance; but, keeping to the design with which I started, and which was only that of pointing out where useful pathological knowledge may be gained, I will speak of only some of the changes which are produced by insects. The most remarkable of these are the galls; and, among the many hundreds of them that have been described, I may assume that you know some in their natural mode of growth—such as the common oak-apple, with which some celebrate the restoration of our monarchy; and the bedeguar of the wild rose; the bright crimson oak-spangle, the currant-gall, or the artichoke-gall, or the gall of pharmacy. But, besides the hundreds of different true galls, there are still more hundreds of changes of structure in leaves and stems and roots, all produced by the irritant secretions of insects, and all such as may justly be ascribed to processes of inflammation. In some, as in the ‘curl’ of the leaves of the whitethorn, you find thickenings of leaves which are lifted, rolled, or curled into chambers, which serve for defence of the Aphides or other insects; in some, the thickened and distorted clusters of leaves, in buds or on twigs, roll up and are mutually fastened, so as to form the walls of similar defensive lodgings; in some cases, leaves become swollen as with a kind of œdema; in some, their layers separate as if with blistering; or leaves, or stems, or fruits, or clusters of flowers, buds, or roots, produce variously

shaped and variously constructed growths of cellular parenchymatous tissue and cork, and, more sparingly, of woody tissue or of cells whose thick walls become as hard as wood. Besides, some of the monstrous growths of parts of plants, and some of the viviparous variations, and of the undue metamorphoses of leaves, are to be referred to the influence of parasites.

"It may seem bold to speak of so many hundreds of widely various morbid processes as having any essential character in common, or as fit to be included under one name; yet I think we may regard the whole of these as being such as, in our pathology, we should call inflammatory hypertrophies or hyperplasiæ. They all show a rapid increase of lowly organised structures, by derivation from, and in continuity with, those pre-existing. There is, as in the products of our inflammations, a general likeness among these new structures, whatever be the part of the plant from which they are derived, and all bear a general likeness to the structures formed after injuries of actively growing parts. In the morbid growths formed by these new structures, the deflection from the natural shape and construction of the part, in continuity with which they have grown, is often not complete; they often retain marks of characteristic normal forms, and sometimes acquire marks of natural variation from the species. Moreover, all these morbid growths have their origin in what may justly be called 'irritation' of the part on which they grow; and in all of them, I think, we may note signs of degeneracy from natural conditions, either in the absence of stomata or similar structures, or in the presence of the red, or yellow, or other colours commonly noticed in decay.

"Here, I believe, are reasons enough for regarding all these galls and gall-like products of disease, generated in plants by insects, as analogous with a large group of the products of inflammation which we study in our own pathology; and the analogy is not the less because neither group can be circumscribed with any exact definition.

"I will not be tempted to speak long, but I beg you to think long, of the marvellous facts of natural adjustment which we have here, in this intense example of the '*sic vos, non vobis*.' Here are the bare facts. Each species of these parasitic insects can compel some part of a plant into such disease as shall supply good food, or well-built and well-placed lodging, or both, for itself or for its eggs and larvæ, or even for part of the life of its complete offspring. Each

insect selects, by instinct, the very part of the plant which is adapted to its purpose. The provision made at the cost of the plant is exactly adapted in quality to the welfare of the insect or its offspring, and in quantity as well; for both the lodging and the food are made sufficient for any necessary time—for days or weeks, often for many months; in some instances for two or even three years. Nay, more than this, a gall, of which the growth has been provoked by the virus of one insect, may be fit for the food and lodging of another, which, when all seems complete, can penetrate the gall-cavity, and there, as with theft or murder, obtain food and lodging perfectly suited to itself or its progeny. And the whole process in the plant, though it be one of disease, and, in a sense, unnatural, is yet so regular, so constant and specific, that the form and other characters of each gall or other morbid product are usually as constant and characteristic as those of the insect itself, and the differences among the galls are at least as great as those among the insects. Is there, in all the range of natural history, a more marvellous group of facts than may here be studied? If you would like to work out a problem in evolution, find how it has come to be a part of the ordinary economy of nature that a gall-insect compels some part of a plant to grow in a manner which, while injurious to the plant, becomes useful to one insect not yet born, and to another who will in due time invade the gall and kill and feed upon its occupant, and then may itself be invaded and eaten by a third.

“But now of the relation between galls and our specific diseases, such as our eruptive fevers, syphilis, cancer, gout, and others.

“In these galls and other similar diseases in plants we have, it seems, hundreds of specific diseases due to as many hundreds of specific morbid poisons; for the most reasonable, if not the only reasonable, theory of these diseases is, that each insect infects or inoculates the leaf or other structure of the chosen plant with a poison peculiar to itself. The poison may be merely deposited; but, in the instances best for study, it is inserted in the plant-structure, whether leaf or any other; and the wound for inserting it, the poisoned wound, may be made either with part of the oral apparatus, or, as in most of the true galls, with the ovipositor through which one or more eggs are passed with the virus, and are left among actively living structures of the plant. The little wound closes; the virus, whether an oral or an ovarian secretion, remains; and the result of its influence on the plant-

structures and their contained protoplasm is the formation of the gall or other morbid product. The whole process may be compared with the local consequences of the insertion of vaccine lymph, or any such morbid poison, in ourselves or other animals. I say the local consequences, for we have no clear evidence of what might be called general infection or constitutional disease in the gall-forming plants. In the absence of quickly moving fluid, such as lymph or blood, the virus infects only the part in and very near to which it is inserted. A single oak-leaf may have fifty 'spangle' galls on its under-surface, but the structures between them may be quite healthy ; and when in any instance a general damage is done to a plant by gall-growths, it seems to be only as a remote consequence of the spoiling of considerable portions of its structures. And this appears to be true, even though the virus may continue active for a long time, as in the galls which begin to grow soon after the insertion of the virus with the ovum, and continue to increase during the whole—sometimes long—development of the larvæ ; or even, in a few instances, after the larvæ have deserted them.

* * * * *

“We find hundreds of different forms of galls, and we may be nearly sure that there are as many kinds of morbid poisons produced by the gall-insects, each form answering to a different virus. This may suggest that we may be too grudging in thinking of the number of morbid poisons, or of their modifications in the blood, to which diseases in ourselves may, at least in part, be due.

“It is true that the galls are produced by many species of insects on many species of plants ; and that the differences among these species may be as wide as those between ourselves and any other Mammalia. But, even among closely allied species, there are many and very different forms of galls. Mayr, ten years ago, described and figured ninety-six kinds of galls found on the oaks of Central Europe, all but two of them being produced by different species of gall-wasps. Of those ninety-six kinds, thirty-two are formed on the leaves alone ; and even on similar parts of one oak-leaf it is not rare to find three or four different forms of galls.

“We have, thus, clear evidence of a very large number of morbid poisons, each of which is capable of producing, in an appropriate subject, a distinct specific disease with a characteristic morbid structure.

* * * * *

"It may be observed, however, that these great differences are marked in outer shape and construction much more than in minute structure. As, in human pathology, there are certain general characters and degrees of likeness in all inflammatory products, however differently they may be constructed—in pustules, vesicles, thickenings, opacities, adhesions, scars, fibroid and other changes; so, in galls, there are certain likenesses in minute structures, even among those that are, in their construction, size, and outer shape, most unlike.

"It may be well to learn from this a lesson on the imperfection of our methods of minute research. As we cannot doubt that the differences in outer shape and method of construction of the products of specific diseases are associated with differences of chemical composition and ultimately minute structure, so it must be in those yet greater differences on which we frame our distinctions of species in all living nature. The coarse, visible, and tangible distinctions may be well marked; the really material differences with which these are associated, and to which probably they are due, are beyond our reach.

"Again, in the study of specific diseases in ourselves, we see many variations due to the differences in the parts, or even in the persons affected with them. In the study of galls, similar variations may be seen. As a general rule, each gall-insect lays its eggs in one part of one plant—as the leaf, leaf-stalk, bud, fruit, or root of this or that species; but if—as rarely happens—one lays in different parts of the same plant, there is usually a very close agreement in the characters of the resultant galls. A few exceptions to this rule are known, one of them being in the very different galls produced on the roots and on the leaves of vines by *Phylloxera vastatrix*; but the rule is generally observed, and accords with the fact of certain features of general likeness being observed in the products of our several specific diseases, wherever they may be seated.

"When the same insect lays in similar parts of different plants, the galls may be all similar; but I believe that they more usually are different, and that their differences are such as bring them severally nearer to the distinctive characters of the plants on which they grow; just as, in ourselves, a specific disease may be modified by the personal conditions of each patient.

"In similar analogy, the differences are yet greater when the eggs are laid in different parts of different plants.

"Very rarely, the same insect may produce on one leaf different forms of galls.

"In all these points you may, I think, find help in the study of specific diseases. I will add only one more. Usually, the gall begins to grow directly after the deposit of the egg; but sometimes there is a long delay, a long period of suspense, an "Eiruhe," which may last for many months before the growth begins. What is going on during this time? I believe we may see here an instance of events very difficult to study in our own pathology, in which two or more conditions must concur to the production of some disease, and one of them must wait for the complete efficiency of the rest. In the case of these long-delayed galls, either the egg, after being laid, requires a long time for the completion of changes ending in the production of the necessary morbid poison, or the plant-structure in which it is laid requires the time for changes to make it susceptible of the poison; or both egg and plant may need to change. So, in us, two or more conditions must concur. A tendency to gout may be inherited, and the blood may have slowly acquired the necessary morbid condition; but no structure may be susceptible of gouty disease till a blow, or a strain, or some disturbance of nervous force makes it so. So with cancer; a general tendency may be inherited, but it must wait till the material of some structure is, by age, or injury, or long-continued 'irritation,' changed into fitness for concurrence in morbid action with the material on which the general tendency depends. * * * * In the growth of these galls, the comparison may seem less far-fetched. At least, it may be difficult to suggest any nearer comparison for a process in which the meeting of two living materials from different organisms is immediately followed by such a change in the method of life of one of them, as ends in the production of a definite new growth exactly adapted to the method and purpose of the life of the other.

"But it is more than time that I should have done with galls. If I have been tedious, let me assure you that I am myself ashamed to have gathered so little from the rapidly increasing records concerning them to which the botanists, and still more the entomologists, of our time are contributing. And, even for that little, I feel as if I deserved to be compared with one of those burglars of whom I spoke as feeding on the results of other's labours. Let it be my apology, that I believe I have taken nothing that those others would have used. I have only taken from their rich stores of facts some that may be much more useful in pathology than

in natural history. And I am sure, from all I know of naturalists, that they will gladly let any of you into their fields, though you may use them for your own purposes much more than for theirs. It would be difficult to find a field for the study of the very principles of pathology larger or richer than this offers to you. The objects are within easy reach; hundreds of morbid processes are at hand for deliberate study; experiments may be made at will; during many months, thousands of insects, as natural vivisectioners, will be at work for you, and it must yet be some years before they will be required to take out licences." [*Op. cit.*, pp. 20—28].

With these pregnant suggestions, I now leave the origin and growth of galls, and pass on to the insects which produce them; but once again expressing the opinion that mechanical irritation rather than the action of a specific virus is the probable explanation of gall-growth.

The vegetable-structure of the various galls deserves a separate memoir, and I leave this in the hands of some of our botanical members, contenting myself with referring them to the following important articles by Meyen,¹⁶ Lacaze-Duthiers,¹⁷ Prillieux,¹⁸ Beijerinck,¹⁹ Courchet,²⁰ and Frank.²¹

¹⁶ Meyen, 'Pflanzen-pathologie' (1841), divided into:—'Auschwellungen,' *Odemata*, pp. 63—65; 'Blasenformige Auftreibungen,' *Emphygmata*, pp. 65—66; 'Fleischgewächse,' *Sarcomata*, pp. 66—68; 'Galläpfel,' *Gallæ* (on oaks chiefly), pp. 68—71. There is also a French version, 'Traité de Pathologie Végétale.' I have not been able to find the works either in the libraries at British Museum, Kew, or the Linnean Society.

¹⁷ 'Recherches pour servir à l'histoire des Galles,' par M. Lacaze-Duthiers. 'Annales des Sciences naturelles,' Botanique, 3rd Series, vol. xix., pp. 273—354; pl. 16—19 (Paris, 1853).

¹⁸ 'Études sur la formation et le développement de quelques Galles,' par M. Ed. Prillieux. 'Annales des Sciences naturelles,' Botanique, 6th Series, vol. iii., pp. 113—137; pl. 16—18 (Paris, 1876).

¹⁹ 'Bijdrage tot de Morphologie der Plantengallen.' By M. W. Beijerinck. 92 pp. and 2 plates (Utrecht, 1877).

²⁰ 'Étude sur les Galles causées par des Aphidiens,' par M. L. Courchet. 'Académie des Sciences et Lettres de Montpellier; Mémoires de la section des Sciences,' vol. x., pp. 1—102; pl. i.—vi. (Montpellier, 1881).

²¹ Frank's 'Die Krankheiten der Pflanzen.' Breslau, 1881. For galls, see pp. 661—798.

Réaumur's 12th Memoir²² might be consulted with advantage, and Malpighi²³ should also be referred to.

The natural history and affinities of the gall-producers come more within the field of my own entomological studies; but before entering upon that branch of my subject, I should like to call attention to the "individuality," so to speak, of a gall. Dr. Mayr has already recorded the fact (and I have myself frequently noticed the same thing) that when such galls as those of *Aphilothrix radialis*, *Andricus terminalis*, or *Dryophanta folii* are detached from their root, bud, or leaf, and supplied with moisture, or kept on damp earth or sand, they grow considerably. This is probably owing to the swelling of their cells and the attenuation of the cell-walls. The oak spangle galls (*Neuroteri*) nearly double in size, and almost the whole growth of the inner larva-cell takes place when the gall is on the ground, after its fall from the leaf; this must greatly alter or modify the individual cellular structure.

Two animal sub-kingdoms include species which are vegetable gall makers, although these structures are mostly the work of insects. Two or three species of Anguillulidæ are known as gall-producers; these belong to the Annuloida. Among the Arthropoda nearly all the species of the somewhat abnormal but large genus *Phytoptus*, belonging to the Acaridea (or Mites), are gall-makers, and many of them produce some of our commonest plant-deformities (*e. g.*, on the birch, lime, maple, sycamore, alder, willow, blackthorn, &c.).²⁴ For some time these were believed to be but true vegetable growths, and were described as Fungi. Of the nine orders belonging to the class Insecta, few contain gall-makers—Collembola, Thysanura, Orthoptera, and Neuroptera being the exceptions.

²² 'Mémoires pour servir à l'histoire des Insectes,' par M. de Réaumur. 12th Mem. 'Des Galles des plantes et des arbres.' Vol. iii., pp. 413—582; pl. 34—47 (Paris, 1737); vol. iii., pt. ii., pp. 176—333; pl. 34—47 (Amsterdam, 1738).

²³ 'Anatome plantarum,' Marcelli Malpighii. Part ii. 'De Gallis'; pp. 22—50; pls. vi.—xxi., figs. 7—74 (London, 1679).

²⁴ See 'Economic Entomology.' By Andrew Murray, F.L.S. Aptera, pp. 331—374. (London, n. d. [1877]).

Gall-makers are found amongst two families of the highly specialised Hymenoptera. A few sawflies (Tenthredinidæ) produce galls, but it is to the allied family Cynipidæ that the gall-flies *par excellence* belong. The life-history of the Cynipidæ is somewhat varied. It contains parasites (true murderers), inquilines (true burglars), and gall-makers (true house-holders).

The study of the imagos will be found somewhat puzzling to the general entomologist, as there is a very general likeness amongst the species; and even the cuckoo gall-flies, or *Synergi*, which are inquilines (lodgers in galls), greatly resemble the true gall-producers. In several instances Linné²² and other systematists have taken the one for the other. Other genera of Cynipidæ are parasitic on the Siricidæ, on various Diptera, and on plant-lice (Aphides); but it is with the gall-making species only we are just now concerned. I will, however, take this opportunity of warning the student how

²² Of the 19 species of *Cynips* described by Linné (Syst. Nat.), 7 only are true gall-makers, the other twelve being either inquilines or parasites. Fabricius noticed 23 species of *Cynips*; many are referable to gall-makers of other orders than Hymenoptera, and there the inquilines, parasites, and gall-makers are equally confused. Neither of these great masters of Entomology referred to Malpighi's remarkably accurate descriptions and figures in his 'De Gallis' (1686).

This note reminds me of a distinguished Essex gall observer, Rev. W. Derham, D.D., F.R.S., &c., Canon of Windsor, and for many years Rector of Upminster, in this county. In his 'Physico-Theology,' altogether a remarkable series of sermons, or Boyle lectures (1711 and 1712), there is much curious information about our Essex gall fauna. Part of one note runs thus:—"Since my penning this I have met with the most sagacious Malpighi's Account of Galls, &c., and find his Descriptions to be exceedingly accurate and true, having traced myself many of the Productions he hath mentioned. But I find Italy and Sicily (his Book *De Gallis* being published after he was made Professor at Messina) more luxuriant in such Productions than England, at least than the Parts about Upminster (where I live) are. For many, if not most of those about us, are taken Notice of by him, and several others besides that I never met with; although I have for many Years as critically observed all the Excreescences, and other morbid Tumors of Vegetables, as is almost possible, and do believe that few of them have escaped me."—*'Physico-Theology.'* Tenth Ed., p. 386, note z. (London, 1742).

necessary it is to keep each species of gall separate, as it will greatly assist him in his studies until he is conversant with the gall-makers, their inquiline and parasites. How large is the subject will be seen when I mention that the late Francis Walker bred 54 species of insects from the well-known "oak-apple" (gall of *A. terminalis*)²⁰; and so with our now commonest oak-gall—the Devonshire or marble gall of *Cynips Kollari*. Up to 1872 but two extra lodgers other than the legitimate inhabitants of this gall were known. In two recent articles²¹ I have been able to identify 75 Hymenoptera, 12 Lepidoptera, 18 Coleoptera, 1 Orthopteron, and 2 Neuroptera, in all 108 species; the whole bred from the small world of a *C. Kollari* gall, and still I believe these various tenancies are far from exhausted.

The cycle of life in the gall-making Cynipidæ forms a subject of the greatest biological interest. The older authors were generally astonished, and expressed their inability to find a satisfactory explanation; and it was not until some fifty years since that the various methods of reproduction received that scientific treatment which they deserved. The Cynipidæ and Aphididæ amongst the hexapods divided the interest in being the highest exponents of the various processes of non-sexual reproduction. Professor Owen, who is still amongst us, was the first to employ the term "parthenogenesis"²²; Professor Huxley²³ made some most important researches on the life-history of the Aphididæ; von Siebold²⁴ (who also is still with us) and Hartig²⁵ (who went over to the majority but last year) on the Cynipidæ. The theories of non-sexual

²⁰ 'Zoologist' iv., p. 1454 (1846).

²¹ 'Entomologist' xii. 113 (May, 1879); xiii. 252 (November, 1880).

²² 'On Parthenogenesis, or the successive production of procreating individuals from a single ovum.' London, 1849. Consult Félix Plateau's 'Etudes sur la Parthénogenèse,' Gand. 1868.

²³ "On the agamic reproduction and morphology of Aphis." 'Trans. Linn. Soc.,' vol. xxii., pp. 193—236, pl. 36—40 (1858).

²⁴ Germar's 'Zeitschrift für die Entomologie,' vol. iv., pp. 379—381 (1848).

²⁵ Germar's 'Zeitschrift für die Entomologie,' vol. iii., pp. 322—329 (1842); vol. iv., pp. 396—400 (1843).

reproduction are too complex to be examined or enunciated here; still this subject has such a great influence on Cynipid life—the whole production of oak galls generally—that I cannot pass on without shortly referring to it, more especially as we have lately received such important additions to our knowledge, through the discoveries of Dr. H. Adler, that a radical reform of our whole nomenclature and arrangement of the gall-making Cynipidæ must follow as a necessary consequence.

It is still a fact that in *Cynips* (*sensu strictu*) and some other genera the male is quite unknown. Hartig satisfied himself of this fact by collecting large quantities of the gall of *Dryophanta disticha* (a species of which the sexual form is still undetermined); in one year he bred some 10,000 gall-flies, but he failed to obtain a single male. The late Frederick Smith made similar experiments on *C. Kollari* galls, and I have myself collected these galls by the thousand in the hope of breeding the long-looked-for male *Cynips*, but with no satisfactory result. The circumstantial evidence of parthenogenetic reproduction is therefore incontrovertible; by this is understood the production of new individuals or fertile ova by virgin females. Similar phenomena are known to occur with insects of several orders, and it holds commonly with many Tenthredinidæ, which are so closely allied to the Cynipidæ. From Hartig's time—the father of cecidology—the Cynipidæ included several agamous or asexual genera besides the usual sexual genera; amongst the gall-producers such species occurred in about equal proportions. No explanation of this anomaly was forthcoming. In America Osten-Sacken and Walsh tried to cut the knot, and the announcement of the discovery of a male belonging to the genus *Cynips* was made. This species (*C. spongifica*), of which I exhibit male specimens, is by no means, however, a typical *Cynips* as the genus is understood in Europe.²² Mr. H. F. Bassett²³ was the first to adduce any substantial facts in

²² Dr. Mayr puts it in the genus *Amphibolips*, Reinhard.

²³ "On the Habits of certain gall insects of the genus *Cynips*." 'Canadian Entomologist,' vol. v., pp. 91—94 (May, 1873).

support of the metagenesis theory mentioned by Dr. Reinhard²⁴ as more probable than the dimorphic hypothesis which had previously been foreshadowed by Osten-Sacken²⁵ and in Walsh's papers in the 'Proceedings' of the Entomological Society of Philadelphia.²⁶ Bassett writes that "from all the above facts I infer that all our species that are found only in the female sex are represented in another generation by both sexes, and that the two broods are, owing to seasonal differences, produced from galls that are entirely distinct from each other." This hypothesis has now been proved to be the true gall-fly history, and in the Cynipidæ we have very distinct exponents of the metagenesis theory or so-called "alternation of generations," which we know is so generally the case with the Scolecida and Hydrozoa.²⁷ Dr. H. Adler first actually proved the fact with *Neuroterus lenticularis* and *Spathogaster baccarum*,²⁸ and this important discovery has been followed up with other researches made with various gall-flies on numerous small oak-trees planted in pots; the theory has thus been established in 19—really 38—distinct species. This has revolutionised the whole history of the Cynipidæ. Dr. Adler's remarkable memoir,²⁹ detailing his observations and with notes on the structure of both the galls and gall-

²⁴ "Die Hypothesen über die Fortpflanzungsweise der eingeschlechtigen Gallwespen." 'Berliner Entomologische Zeitschrift.' Vol. ix. (1865).

²⁵ "Ueber die Gallen und andere durch Insecten hervorgebrachte Pflanzen-deformationen in Nord-America." By Baron Osten-Sacken. 'Stettiner Entomologische Zeitung,' vol. xxii., pp. 405—423 (Oct.—Dec., 1861).

²⁶ Vol. i., pp. 47—72 (Oct., 1861); pp. 241—259 (Sept., 1862). Vol. ii., pp. 33—49 (April, 1863); pp. 443—500 (March, 1864). Vol. iv., pp. 331—380 (May, 1865).

²⁷ [The words "cyclical propagation," introduced into England by Mr. Meldola in his Annual Address to the Essex Field Club (Jan. 12th, 1892), to denote the idea hitherto known by the awkward phrase "alternation of generations," are so much more convenient, and so neatly express the true nature of the phenomena, that they should be adopted in future by all biologists.—ED.]

²⁸ 'Deutsche Entomologische Zeitschrift' xxi. 209—248 (1877).

²⁹ "Über den Generationswechsel der Eichen-Gallwespen." 'Zeitschrift für wissenschaftliche Zoologie,' vol. xxxv., pp. 161—246; pl. x., xi., xii. (1890).

flies, should certainly be carefully studied. The agamous genera *Aphilothrix*, *Neuroterus*, *Dryophanta*, and *Biorhiza* are but æstival parthenogenetic generations of the sexual genera *Andricus*, *Spathogaster*, and *Trigonaspis*, but Dr. Adler still leaves four species of *Aphilothrix* (*A. seminationis*, Gir., *A. marginalis*, Schlecht., *A. quadrilineatus*, Hart., and *A. albopunctata*, Schlecht.) whose generations, he tells us, are exclusively parthenogenetic—"the alternate sexual generation does not exist." *Cynips* is still untouched. This varying biography and linking of structurally different forms into one species is deeply interesting, and leads to most important considerations and results which we cannot now further follow out.

Amongst the cynipideous gall-makers the genus *Rhodites* limits itself to the rose, and other species produce galls on the bramble, ground-ivy, *Hieracium*, *Potentilla*, poppy, &c.

The larvæ of the Cynipidæ are fat, fleshy, apodal, whitish grubs; they pupate in the galls, without exception.

We have but few British sawflies which produce galls, and I am only able to include three species in our Essex list. These all occur on willows, and are produced by species of the Nematidæ. The very common bean-shaped gall of *Nematus gallicola*, which is so commonly seen projecting from both sides of the leaf of many willows, must be well known to all. Its manner of reproduction is very commonly parthenogenetic, the male *N. gallicola* being excessively rare. The late Mr. F. Smith did not meet with it until 1878, the year before his death; and he worked assiduously at the Hymenoptera for upwards of fifty years. It is somewhat remarkable that a beetle (*Balaninus Brassicæ*) is a very general inquiline, or lodger, in these galls. Unlike the Cynipidæ, the gall-making sawflies do not undergo their metamorphoses within the gall, but the larvæ leave it when full-fed and pupate in the ground. The *Cryptocampi* are an exception; their cocoons are formed within the woody galls.

In the Diptera, as in the Hymenoptera, we have one large gall-producing family—the Cecidomyidæ, whose numerous species are commonly known as gall-gnats. Seventy-six

British species are known to produce galls, and many of these are amongst our most familiar ones,—e. g., the dewberry-stem gall, the willow rose-gall, the beautiful little purse-like gall on the leaves of the meadow-sweet, the ground-ivy leaf-gall, the shining yellow and red nodules on the stems of the bed-straw, &c.; but as I have lately given a synopsis of the British species in the 'Entomologist,'⁴⁰ I must refer the reader to that paper for information respecting such species as have not yet been found in our county. Most of the galls made by the Cecidomyidæ are especially noticeable, and, as I have said, many are quite familiar to us; still the gall-gnats themselves are very small, obscure, and easily overlooked by the general naturalist, although a specialist writes of them, "these flies (Cecidomyidæ) are the most elegant and delicate little creatures in the whole of the Diptera." Their life-history is very varied, and as the nature of their metamorphosis is of consequence when breeding the flies, so that the student may know whether they pupate in the gall or otherwise, I have noticed this in the table of species.

Another family of the great order Diptera—the Trypetidæ, whose economy is so especially interesting to the phytologic entomologist—includes a few gall-makers, besides numerous leaf-miners, leaf-blotchers, flower-feeders and fruit-feeders. The bright-coloured, spotted and banded winged, flies are objects of especial beauty, and are easy of specific arrangement. The galls produced by them nearly all occur in the seed-capsules and flower-heads of various Compositæ, and are therefore not very noticeable, but the well-known thistle-stem gall of *Urophora Cardui* is an exception. The Trypetidæ pupate within the galls. Two or three other fly-galls are known, but they call for no especial remarks, except their diversity of habits from their congeners, so we will pass on to the Aphis galls, about which I must also be very brief, although they really deserve a separate paper. The pine-apple-like fir galls and elm and poplar leaf-galls are familiar examples of their productions, but their economy is especially involved and obscure. The interesting biological questions

⁴⁰ 'Entomologist' xiii. 146—154 (July, 1880).

connected with their reproduction and whole life cycle were first studied in this country by Newport and Huxley, and at the present time M. J. Lichtenstein is so patiently and successfully tracing some of the Aphides through their various stages of development (which is so abnormal that he has had to employ a peculiar nomenclature of his own to distinguish the seven buddings or pseudo-births in certain genera) that I am sure the members of the Club would welcome a resumé of his researches, but I can now only refer them to Mr. Buckton's three beautiful volumes, recently published by the Ray Society,⁴¹ and to Courchet's memoir⁴² before alluded to.

There are several species of *Trioza*, a genus of Psyllidæ (Homoptera), which cause swellings and rollings of leaves, especially of several Compositæ; but the only gall-making species yet noted as British is *T. Walkeri*, Först., whose larvæ lives in the deformed leaves of buckthorn. The common terminal globularly-swollen leaves of box, so well figured by Réaumur, in which the larvæ of *Psylla Buxi* live, can hardly be called a gall.

Both the Coleoptera and Lepidoptera contain a few gall-producing species. The common cabbage and other cruciferous root-galls are familiar examples of the former, and the knot-grass (*Polygonum*) pod-gall⁴³ of *Asychna ærutella*, and *Laverna decorella*, whose larvæ produce swellings in the stems of various species of *Epilobium*, are the only British exponents of the latter. Further than their departure of habits from other members of their groups, and their special bearing on the various problems connected with gall-growth generally, they afford no peculiar interest from our present point of view, and they will doubtless receive more attention when the coleopterous or lepidopterous fauna of our county is under consideration.

⁴¹ 'Monograph of the British Aphides,' by George Bowdler Buckton, F.R.S., F.L.S., F.C.S., &c. London: Printed for the Ray Society. Vols. i.—iii. (1876—1881).

⁴² "Études sur les galls causées par les Aphidiens" par L. Courchet (Montpellier, 1879). Compare reference on p. 111.

⁴³ 'Entomologists' Weekly Intelligencer,' v. 81 (Dec. 11, 1858).

This paper is by no means exhaustive either in botanical, zoological, or biological detail; still I think enough has been referred to, to show the interest accruing to gall study, and the many intricate problems of the greatest importance still awaiting a satisfactory solution. Should any members of the Essex Field Club feel disposed to make observations or experiments, I shall be pleased to place what little knowledge I have of the subject at their disposal. Further, I shall be pleased to name any collected specimens of galls, which are more easily determined in many cases than the insects themselves, which may be sent to me (to Maldon, Essex), and thus, I hope, make numerous additions not only to our county list, but to the fauna of Britain itself.

As to the present knowledge of our number of species of gall-making insects, Essex compares thus with Britain and with Europe:—

	Europe.	Britain.	Essex.
Cynipidæ	128	53	40
Tenthredinidæ.....	12	8	3
Tineina	8	2	1
Cecidomyidæ	176	76	30
Mycetophilidæ.....	1	1	1
Trypetidæ	11	5	2
Muscidæ	5	2	1
Curculionidæ	12	8	5
Aphididæ	12	8	6
Psyllidæ	12	1	0
	<hr/> 872	<hr/> 164	<hr/> 89

In the following synopsis of the galls of the county, I have arranged them under two headings: I. BOTANICAL—in accordance with the names and arrangement in Benthams's 'Hand-book of the British Flora,' as being the most generally useful book for the entomological botanist, the minute subdivision of species adopted in some floras not being necessary in this case. A short description, and frequently a figure, of each gall is given under the plant on which it occurs, the name of the gall-maker following the diagnosis. II. ENTOMOLOGICAL—in the ordinary sequence of the families of the insects form-

ing the galls. I have added a few Essex localities, but these must be taken as being very far from exhaustive; when increased attention is paid to these interesting productions the limits of the distribution of the more uncommon forms will doubtless be greatly extended."

SYNOPSIS OF SPECIES.

PART I. BOTANICAL ARRANGEMENT.

RANUNCULACEÆ.

RANUNCULUS REPENS, L.

Leaf. The palmate segments of the lower leaves are rolled inwards from the base, forming a thickened and hard pseudo-gall. The orange-red larvæ pupate within the gall. *CECIDOMYIA RANUNCULI*, Bremi. (Fig. 1).



FIG. 1. *Cecidomyia Ranunculi*.

PAPAVERACEÆ.

PAPAVER RHŒAS, L. **Capsule.** The seed-capsule is much distorted, swollen and hardened. It contains many larvæ cells of the Cynipid, which pupates in the gall. *AULAX RHŒADIS*, Hartig.

CRUCIFERÆ.

BARBAREA VULGARIS, Br. **Flowers.** In May the yellow flowers become galled and do not open; the anthers become greatly swollen, and the whole bloom deformed. The yellow larvæ pupate within the gall. *CECIDOMYIA SISYMBRII*, Shrank.

" [The issue of some projected instructions on the best methods of breeding gall-flies, with hints for the study of the same, is postponed, in order to avoid delay in the publication of this part of the 'Transactions,' but Mr. Fitch has kindly promised to make these matters the subject of a separate communication to the Club.—ED.]

BRASSICA OLERACEA, L. Stem. The stock is covered with irregular swellings or knots; each gall contains a single larva, but frequently a number of galls coalesce and form a composite gall as large as a walnut. The larvæ leave the galls in early spring and pupate in the ground. The destructive cabbage-gall beetle. **CEUTHORHYNCHUS SULCICOLLIS**, Gyllenhal. (Fig. 2).



FIG. 2.

Ceuthorh. sulcicollis.

BRASSICA CAMPESTRIS, L. Root-stock. The turnips and swedes are most commonly disfigured by hard swellings on the surface of the "roots"; each of which contains the larvæ of the beetle, but possibly of a different species from the cabbage-gall beetle. The larvæ in the white turnips and swedes differ in colour and slightly in structure. Pupates in the earth. **CEUTHORHYNCHUS SULCICOLLIS**, Gyllenhal.

BRASSICA SINAPISTRUM, Boiss (*Sinapis arvensis*, Eng. Bot.). Root. The stalk is galled just below the ground, causing an irregular, round, white, hard, swelling, which contains generally but a single yellowish-white larva; but two or three galls sometimes coalesce on the same plant. The larva pupates in the ground. **CEUTHORHYNCHUS ASSIMILIS**, Paykull.

RAPHANUS RAPHANISTRUM, L. Root. Similar swellings, just about the surface of the ground, to the charlock galls. **CEUTHORHYNCHUS ASSIMILIS**, Paykull.

CARYOPHYLLACEÆ.

STELLARIA HOLOSTEA, L. Apical leaves. The terminal leaves are smaller, hardened and closely imbricate, generally discoloured. **BRACHYCOLUS STELLARIÆ**, Hardy. Mr. Hardy states (Buckton's 'British Aphides' ii. 148):—"During the summer the *Aphis* migrates from the stitchwort to one of the grasses, *Holcus mollis*. Here it likewise revels in the centre of a tuft of leaves, for these leaves, being prevented from receding, embrace each other at their bases like those of a

sedge. In this manner a kind of boat is formed for the protection of the colony. In the autumn the *Aphis* reverts to the Caryophyllacea."

TILIACEÆ.

TILIA EUROPEA, L. Twig. A round, hard, generally red, swelling of about the size of a pea on the young twigs, more especially on those growing from the roots or base of the trunk. The gall is unilocular, and the larva pupates within it. *SCIARA TILICOLA*, H. Loew.

PAPILIONACEÆ.

SAROTHAMNUS SCOPARIUS, Wimm. Twig. Black, elongate, bud-shaped galls on the upper twigs; several on one twig. The larvæ pupate within the gall. *ASPHONDYLIA SAROTHAMNI*, H. Loew.

TRIFOLIUM REPENS, L. Leaf. The leaflet is folded longitudinally and thickened, often lighter in colour, around the midrib. The larva quits the leaf and pupates in the earth. *CECIDOMYIA TRIFOLII*, F. Löw. (Fig. 8).

LOTUS CORNICULATUS, L. Flower. The flower is much enlarged, and does not open, also much greener in colour. The larva pupates in the earth. *DIPLOSION LOTI*, De Geer.



FIG. 8. *Cecidomyia Trifolii*.

ROSACEÆ.

PRUNUS COMMUNIS, Huds. (*spinosa*, Eng. Bot.). Leaf. The leaf is thickened and formed into a pouch or purse, with the midrib for its hinge; mostly red in colour. The orange larvæ pupate in the ground. I have bred many specimens of the gnat. *CECIDOMYIA PRUNI*, Kaltenbach (undescribed).

SPIRÆA ULMARIA, L. Leaf. Wart-like swellings on the surface of the leaf projecting both on the upper side and under side, mostly reddish above and white or pale green below. Many on one leaf, but only one larva in each gall, within which it pupates. *CECIDOMYIA ULMARIÆ*, Bremi. (Fig. 4).

FIG. 4. *Cecidomyia Ulmarie*.

RUBUS FRUTICOSUS, L. Stem. A considerable thickening of the stem for an inch or more in length, which is at first green and later becomes brown. The gall is multilocular, and is often very conspicuous in winter, showing the holes from which the gall-flies have emerged. *DIASTROPHUS RUBI*, Hartig. (Fig. 5).

FIG. 5. *Diastrophus Rubi*.

RUBUS CÆSIUS, L. Stem. Galls of *D. RUBI*, as on *R. fruticosus*.

RUBUS CÆSIUS, L. Stem. A thickening of the stem, but generally more regularly rounded or oval than in the gall of *D. Rubi*; also mostly much smaller, and does not interfere with the direct growth of the stem, as is often the case with that species. The gall is multilocular, and the larvæ pupate in a snow-white pupa case within it. *LASIOPTERA RUBI*, De Geer.

RUBUS FRUTICOSUS, L. Leaf. Thickened and folded leaf longitudinally along the superior veins. The pale yellow larvæ leave the pseudo-gall and pupate in the earth. *CECIDOMYIA PLICATRIX*, H. Loew.

POTENTILLA REPTANS, L. Stem and leaf-stalk. Hard, brown, very irregularly shaped, though generally round or oval, swellings of the stem or leaf-stalk; these galls are usually multilocular, and occur singly or more frequently many together on a stem. The gall-flies emerge from the

galls in the May or June of the second year. *XENOPHANES POTENTILLA*, Villers.

ROSA CANINA, L. Stem and leaf. The well-known Bedeguar or Robin's pin-cushion occurs on the stem, and frequently single-celled specimens occur as bright red hairy patches on the leaves. The beautiful green and red multi-locular galls vary much in size and shape, and the desiccated specimens are often conspicuous objects in the hedges in winter. The gall-flies emerge from the galls in spring. *RHODITES ROSÆ*, Linné. (Fig. 6).



FIG. 6. *Rhodites Rosæ*.

ROSA CANINA, L. Leaf and leaf-stalk. The smooth, round, pea-sized galls occur generally on the under side of the leaflet, but occasionally on the upper side or on the leaf-stalk, and I once found a specimen on the fruit. They are green in colour, reddish when turned to the sun, but later become brown; their attachment to the leaf is very slight, and when mature they fall to the ground at the least touch. The gall-flies emerge in spring. *RHODITES EGLANTERIÆ*, Hartig. (Fig. 7).



FIG. 7. *Rhodites Eglanteria*.

ROSA CANINA, L. Leaf. These galls are somewhat similar to the last, but are beset with from three to six spines of unequal length on their surface. They occur on the under side of the leaflet, and generally resemble those of *R. Eglanteria* in situation, size, structure, &c., with the above exception. *RHODITES ROSARUM*, Giraud. (Fig. 8).



FIG. 8. *Rhodites Rosarum*.

ROSA CANINA, L. Leaflet. The leaflets are conduplicate — folded longitudinally and thickened, and this pseudo-gall is generally reddish brown in colour. The whitish larvæ quit the leaves and pupate in the ground. *CECIDOMYIA ROSARUM*, Hardy. (Fig. 9).



FIG. 9.
Cecidomyia Rosarum.

CRATEGUS OXYACANTHA, L. Leaf. The twigs, especially of trimmed hedges, are frequently disfigured with terminal rosettes of leaves; these are much distorted, curled and thickened. The larvæ sometimes pupate in the galled bunch of leaves, but more generally in the earth. *CECIDOMYIA CRATEGI*, Winnertz.

ONAGRACEÆ.

EPILOBIUM MONTANUM, L. Stem. The stems are swollen in places into hard, round, knots of about the size of a pea, but their growth is hardly interfered with. The white cocoons sticking out of the stem are conspicuous objects after the emergence of the moths. *LAVERNA DECORELLA*, Stephens.

UMBELLIFERÆ.

PIMPINELLA SAXIFRAGA, L. Seeds. One or both seeds are much enlarged and rounded, remaining smooth and green; often several are galled on one umbel. These galls also occur in the umbels of parsnip and carrot. The bright orange larvæ pupate in the ground. *ASPHONDYLIA PIMPINELLÆ*, F. Löw. (Fig. 10, as it occurs on *Daucus*).



FIG. 10.
Asphondylia Pimpinellæ.

CORNACEÆ.

CORNUS SANGUINEA, L. Leaf. The gall consists of a hard, reddish, truncate cone thrust half-way through the leaf, and

plainly visible on both sides. It is multilocular, but the larvæ leave the gall and pupate in the earth. *HORMOMYIA CORNI*, Giraud.

STELLATÆ.

GALIMUM VERUM, L. Stem. Smooth, shining, somewhat hard, pink or whitish swellings of the stem; single galls are generally more or less round, but several galls mostly occur together. The stem itself is not further distorted; occasionally the galls occur on the flower-stalks. The orange larvæ leave the gall and pupate in the earth. *CECIDOMYIA GALII*, H. Loew.

COMPOSITÆ.

ACHILLEA MILLEFOLIUM, L. Leaf axils. These are cup-like, thickened, greenish, or purplish brown, swellings occurring singly or in pairs in the axils of the leaves; the tops of the galls are irregularly coronate, and the larvæ emerge thence and pupate in the earth. *HORMOMYIA MILLEFOLII*, H. Loew. (Fig. 11).



FIG. 11.
Hormomyia Millefolii.

TANACETUM VULGARE, L. Leaf, stem, flower. The single gall is smooth, green, bell-shaped or ovate, with a notched crown at the apex; it opens here when mature. The walls are thick and fleshy, and each gall contains but one larva; frequently, however, two or more coalesce, and occasionally the stem is completely surrounded with the confluent fleshy galls. The galls mostly occur singly on the midribs and pinnæ of the leaves, or several together in the axils of the leaves, or as a terminal bunch on young plants; more rarely seven or eight galls may be found on the receptacle of the flowers, these generally purple and green in colour. The bright orange larvæ pupate in the earth, but frequently also in the galls. *OLIGOTROPHUS* (*HORMOMYIA*) *TANACETICOLUS*, Karsch, or possibly only a variety of *H. MILLEFOLII*, H. Loew.

ARTEMISIA VULGARIS, L. Leaf. Small, red or red and green galls on the upper surface of the lower leaves. The larvæ pupate within the galls. *CECIDOMYIA FOLIORUM*, H. Loew.

CARDUUS ARVENSIS, Curt. Stem. The stem is considerably swollen into a hard, woody, ovate, or globular gall, but the stem continues to grow and leaves are produced above the gall. The gall is most commonly found in cultivated fields. The galls are multilocular, containing from two to eight fat, white larvæ with brown heads, which pupate within the gall. *UROPHORA CARDUI*, Linné. (Fig. 12).



FIG. 12. *Urophora Cardui*.

CENTAUREA NIGRA, L. Flower-head. The ovary is transformed into hard, woody, irregularly oval, confluent galls to the number of two or three in one flower-head. The appearance of the head is not changed, and the galls are only tactilely noticeable. The white larvæ change to black pupæ within the gall. *UROPHORA SOLSTITIALIS*, Linné.

HIERACIUM UMBELLATUM, L. Stem. Hairy, green, rounded swellings of the stem, generally of about the size of a walnut. The galls are multilocular, and the larvæ pupate therein. *AULAX HIERACII*, Bouché (= *A. Sabaudi*, Hartig).

CAMPANULACEÆ.

CAMPANULA ROTUNDIFOLIA, L. Seed capsules. The galled capsules are much swollen, and become much thickened and fleshy; they are not, however, particularly noticeable. The black larvæ pupate within the galls, often two in one capsule. *GYMNETRON CAMPANULÆ*, Linné.

JASMINACEÆ.

FRAXINUS EXCELSIOR, L. Leaflets. The midrib of the leaflets is much swollen, enclosing an oval purse-like chamber

in which the gall-gnat larva lives. It emerges from the pseudo-gall and pupates in the earth. *DIPLOSIOTIS BOTULARIA*, Winnertz.

SCROPHULARINEÆ.

VERONICA BECCABUNGA, L. Flower-head. The flower-head or seed capsule is transformed into an oval gall of about $\frac{1}{4}$ in. long by $\frac{1}{4}$ in. broad. The yellowish, hairy larva pupates within the gall. *GYMNETRON BECCABUNGA*, Linné.

VERONICA CHAMÆDRYS, L. Leaf. The terminal bud, when galled, becomes arrested in development, and is a thickly-haired, whitish-green tuft. The orange-yellow larvæ pupate amongst the closely imbricated woolly leaves, often several in a pseudo-gall. *CECIDOMYIA VERONICÆ*, Vallot. (Fig. 13).

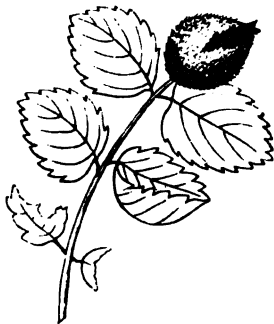


FIG. 13.
Cecidomyia Veronica.

LABIATÆ.

NEPETA GLECHOMA, Benth. (*Glechoma hederacea*, Eng. Bot.). Leaf. Small, hairy, tubular galls, occurring in some numbers on the upper sides of the leaves. When mature the galls readily fall from the leaf, leaving several round holes in it. The single pale yellow larva pupates within the fallen gall. *CECIDOMYIA BURSARIA*, Bremi. (Fig. 14).

NEPETA GLECHOMA, Benth. Leaf, leaf-stalk, stem. Round, oval, or irregularly shaped, hairy, fleshy, green galls, sessile on the leaf-stalk or stem, occupying the place of a leaf, but often with the leaf-edge produced from the gall. The

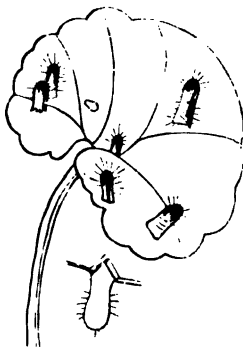


FIG. 14.
Cecidomyia Bursaria.

larva pupates within the mostly unilocular gall. *AULAX GLECHOMÆ*, Hartig. (Fig. 15).

PLANTAGINÆÆ.

PLANTAGO LANCEOLATA, L. Flower-stalk. Greenish, succulent, oval swellings of the peduncles or flower-stalks. The gall is about $\frac{1}{2}$ in. long by $\frac{1}{4}$ in. in diameter, tapering at both extremities into the stalk ; it is strongly ribbed, and is unilocular. The larva pupates within the gall, and the perfect beetle appears in the autumn. *MECINUS PYRASTER*, Herbst.



FIG. 15. *Aulax Glechomæ*.

POLYGONACEÆ.

POLYGONUM AMPHIBIUM, L. Leaf. The leaf-margin is thickened or rolled, mostly on both sides, and is orange or red in colour. The larvæ pupate within the gall. *CECIDOMYIA PERSICARIÆ*, Linné.

POLYGONUM PERSICARIA, L. Leaf. Similar galls to those above described, produced by the same gall-gnat.

EUPHORBIACEÆ.

BUXUS SEMPERVIRENS, L. Leaf. The leaves are swollen and slightly discoloured. The yellow larvæ pupate within the pseudo-gall. *DIPLOSIIS BUXI*, Laboulbène.

The very common terminal leaf-bladders are produced by *PSYLLA BUXI*, Linné.

URTICACEÆ.

URTICA DIOICA, L. Leaf, leaf-stalk, flower-stalk. The galls are mostly globular, hairy, fleshy swellings, either on both surfaces of the leaves themselves, or on the leaf- or flower-stalks, pale green in colour, but frequently rosy ; they occur singly or occasionally in masses. The whitish larvæ leave the galls and pupate in the earth. *CECIDOMYIA URTICÆ*, Perris.

ULMACEÆ.

ULMUS CAMPESTRIS, Sm. Leaves. The galls mostly occur at the ends of twigs on elm bushes or stubs; they consist of much thickened and distorted bunches of leaves, and vary in size from that of a walnut to a fair-sized apple; when fresh they are yellowish green with rosy reflections, and contain a quantity of bluish black mucilaginous liquid, which is liberated with the Aphides when the mature gall splits. The old brown galls are very conspicuous on elm hedges in winter, but they are fitful in appearance, in some years (as 1881) being very abundant, while in others (as 1879 and 1880) they are almost entirely absent. *SCHIZONEURA LANUGINOSA*, Hartig.

ULMUS CAMPESTRIS, Sm. Leaf. These galls occur as pedunculate, smooth galls, attached by their thin end to the upper surface of the leaf, somewhat resembling a filbert in size and shape; they change colour, often to a beautiful bright yellow, earlier than the unaffected leaves. They occur singly, but I have rarely found double specimens; unlike the previous species these galls generally occur on trees; they are much rarer than *S. lanuginosa*, but in some years are by no means uncommon. The gall-makers are mature in autumn. *TETRANEURA ULMI*, De Geer.

AMENTACEÆ.

FAGUS SYLVATICA, L. Leaf. The gall is a hard, pyriform, or somewhat conical, smooth projection from the upper side of the leaf, but also showing through and firmly attached, so that it falls only with the leaf; it is about the size of a cherry-stone, and there are seldom more than one or two on a leaf. The white larva pupates within the gall during winter. *HORMOMYIA FAGI*, Hartig.

FAGUS SYLVATICA, L. The small, hairy, tubular galls occur on the upper side of the leaf, only showing a slight convex projection on the under surface; they are greenish at first, but speedily change to brown or reddish brown in colour, and then fall from the leaf, leaving a white, circular, basal scar

behind (when mature they fall at the least touch). There are generally eight or ten galls on a leaf, occurring on each side of the midrib, mostly in the angle of a side vein. The larva lives in the gall throughout the winter, pupating therein in the spring. *HORMOMYIA PILIGERA*, H. Loew.

QUERCUS ROBUR, L. Root-lets. The galls when single are about as large as a hazel nut, but they generally occur in confused masses of five or six together. The galls are soft when recent, but soon become hard and woody; they are round, oval, or reniform, pyriform when confluent, and contain from three to nine thin-walled, oval larva-cells, which are yellowish on the inside. The galls are mature in the autumn, and the apterous, ant-like gall-flies emerge therefrom throughout the winter.



FIG. 16. *Biorhiza aptera*.

BIORHIZA APTERA, Fabricius (Fig. 16) [agamous form of *ANDRICUS (BIORHIZA) TERMINALIS*].

QUERCUS ROBUR, L. Root. This gall generally occurs just below the surface, where the roots leave the trunk, and is mostly considerably larger than the preceding. It is round, rough, hard, and woody, varying in colour with the surrounding soil from light yellow or reddish to almost black: it somewhat resembles a truffle. In section the gall shows numerous oval larva-cells embedded in its parenchyma. The gall is mature in autumn, and the gall-flies emerge therefrom in April. *APHILOTHRIX RADICIS*, Fabricius (Fig. 17) [agamous form of *ANDRICUS NODULI*].

QUERCUS ROBUR, L. Bark. The gall is tooth- or rather nail-like in shape, and is found deeply embedded in the trunks of old oaks, frequently on the bark encircling the spot where a large branch has been removed on old pollards.

When young it is a smooth, succulent, rounded, greenish gall; but when mature it is hard, brownish, really obconical in shape, but on the surface presenting a circular convex lid

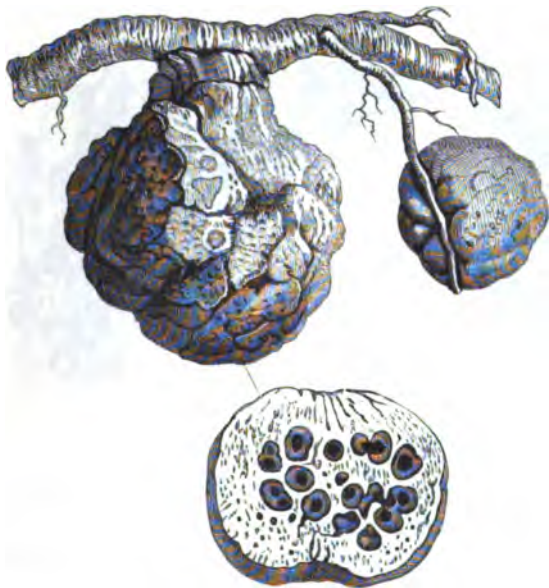


FIG. 17. *Aphilothrix radidis*.

which falls off when mature, showing the pierced, circular, apical, woody septum of the gall surrounded with numerous small, circular punctures, this just below the surface of the bark. The galls are single-celled, but generally occur gregariously; they are mature in autumn, and the gall-flies emerge therefrom in early spring. *APHILOTHRIX CORTICIS*, Linné (Fig. 18) [agamous form of *ANDRICUS GEMMATUS*, Adler].

QUERCUS ROBUR, L. Bark. Small acorn-like, red or brown galls occurring in clusters on the young offshoots of oak-stubs or the smaller



FIG. 18. *Aphilothrix corticis*.

branches of trees. They are hard, conical, single-celled galls, coarsely furrowed on their basal two-thirds. They never occur singly, and when fresh the galls are deep red in



FIG. 19. *Aphilothrix Sieboldii*.

colour, which tint they lose after the emergence of the insect. The galls are mature in September, and the gall-flies emerge therefrom in April or May. *APHILOTHRIX SIEBOLDII*, Hartig (Fig. 19) [agamous form of *ANDRICUS TESTACEIPES*].

QUERCUS ROBUR, L. Stem. The galls are soft, succulent and berry-like, occurring on the trunks of young oaks. They are spherical, pea-sized, bright red or yellowish, and single-celled. The galls, which mature very quickly, really occur on the stem-buds of the



oaks in the spring; they soon shrivel up and disappear after the emergence of the gall-fly, which takes place in June. *TRIGONASPIS MEGALPTERA*, Panzer. (Fig. 20).

QUERCUS ROBUR, L. Twig. Little, glabrous, oval swellings are frequently noticeable on the bark of oak-twigs, more especially when pierced by the gall-flies; these are the galls of *Andricus noduli*. This single-celled gall also occurs on

the young shoots and leaf-petioles; it is mature in summer, and the gall-fly emerges therefrom in August to October. *ANDRICUS NODULI*, Hartig. (Fig. 21).

QUERCUS ROBUR, L. Bud. The smooth, spherical, hard, yellowish brown, bullet gall of *C. Kollari* is now well known everywhere. It is dark or yellowish green when fresh, and occurs on the terminal and axillar buds of the young twigs often in clusters of three or four together. In section the gall, which varies from one-half to an inch in diameter, shows a thick, loose-celled parenchyma with a radiate appearance surrounding one hard-walled, small, round larva-cell. The galls mature in autumn, and the gall-flies emerge therefrom in September and October, and throughout the following spring; the galls do not fall from the twigs upon the emergence of the tenants, but frequently persist even for years. *CYNIPS KOLLARI*, Hartig. (Fig. 22).

QUERCUS ROBUR, L. Bud. The artichoke gall of the oak is about the size of a

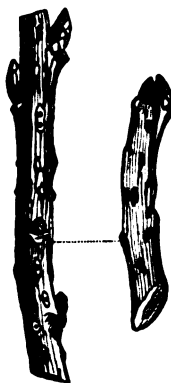


FIG. 21. *Andricus noduli*.

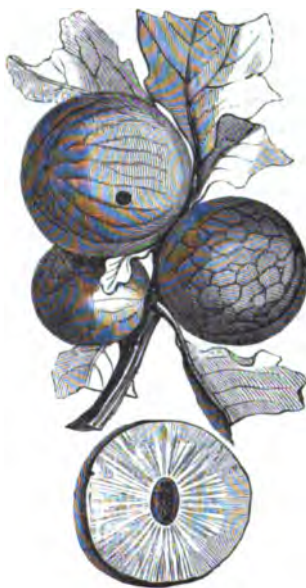


FIG. 22. *Cynips Kollari*.

nut or small walnut, and greatly resembles the fruit of the hop (strobile), or a miniature artichoke. It mostly occurs in the leaf-axils, and consists of a much compressed, woody axis, to which the hairy, brownish green, elongate scales are



FIG. 23. *Aphilothrix gemma*.

attached; these enclose a hard, chocolate-brown, pear-shaped, single-celled inner gall, which is about one-third of an inch in length. The gall is mature in autumn, when the inner gall falls to the ground; the gall-fly emerges therefrom in spring, but occasionally from one- or two-year-old galls. It is commonly found on oak-stubs or young trees. *APHILOTHRIX GEMMA*, Linné. (Fig. 23).

QUERCUS ROBUR, L. Bud. The gall is a small, woody, spindle-shaped growth in an axillar bud; it is reddish brown in colour and thickly covered with similarly coloured pubescence; at the apex is frequently a small conical papilla, and in some instances there is a short, thick foot-stalk at the base. The gall is single-celled, and is mature in autumn, when the gall-fly emerges therefrom. *APHILOTHRIX SOLITARIA*, Fonscolombe. (Fig. 24).

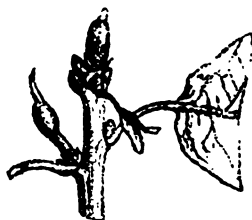
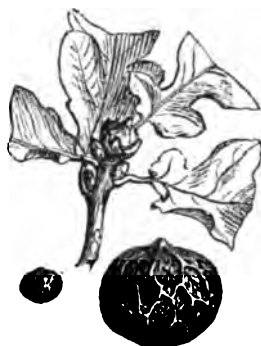


FIG. 24.
Aphilothrix solitaria.

QUERCUS ROBUR, L. Bud. This gall is more conspicuous than any other of the smaller autumnal bud-galls, on account

of its bright green colour. It is spherical, with a small apical papilla, and its surface is covered with inconspicuous raised articulations. The gall is sessile in the terminal or axillar buds; it somewhat resembles a miniature melon. The gall retains its green colour until mature in late autumn; the gall-fly emerges therefrom in spring. *APHILOTHRIX GLOBULI*, Hartig (Fig. 25) [agamous form of *ANDRICUS INFLATOR*].

FIG. 25. *Aphilothrix globuli*.

QUERCUS ROBUR, L. Bud. This gall somewhat resembles that of *A. globuli*, but is purplish green in colour, and in shape and size greatly resembles a grain of wheat; it is sessile, but more deeply seated in the bud than the above-mentioned species, and is by no means so easily seen, although common. The gall is single-celled, and occurs singly in the autumn; it is mature in October, and the gall-fly emerges therefrom in April. *APHILOTHRIX AUTUMNALIS*, Hartig (Fig. 26) [agamous form of *ANDRICUS RAMULI*].



FIG. 26.

Aphilothrix autumnalis.

QUERCUS ROBUR, L. Bud. The unopened oak-buds are frequently seen to be pierced with a small circular hole; if on touching the apex a small, woody, brown, smooth, ovate gall is pulled out, we have the inconspicuous gall of *A. collaris*. It is almost impossible to find the galled buds until after the escape of the fly, when they appear to

FIG. 27. *Aphilothrix collaris*.

be not uncommon. The gall is single-celled, and matures apparently throughout the summer, when the gall-fly emerges therefrom. *APHILOTHRIX COLLARIS*, Hartig (Fig. 27) [agamous form of *ANDRICUS CURVATOR*].

QUERCUS ROBUR, L. Bud. This most remarkable gall is in size and shape much like a barley-corn, but is green in colour, frequently quartered with red raised stripes, and occurs on a long, but very thin foot-stalk, though sometimes



FIG. 28. *Aphilothrix callidoma*.

almost sessile. It is developed from the axillar buds, and is single-celled; it matures in summer and autumn; the gall-fly emerges therefrom in spring. *APHILOTHRIX CALLIDOMA*, Hartig (Fig. 28) [agamous form of *ANDRICUS CIRRATUS*].

QUERCUS ROBUR, L. Bud. This is the most conspicuous of the bud-like galls. It occurs on the twigs of the oak-stubs in the spring, and is somewhat oviform in shape, of about the size of an orange pip; it is green, purplish or whitish green, in colour, commonly covered with short, whitish, longitudinally placed spots; its surface is smooth, and it is sessile in the bud, the bud-scales scarcely showing; there is a well-marked papilla at the apex. The gall is single-celled; it falls from the twig to the ground in May or June, and the gall-fly emerges therefrom in November. *APHILOTHRIX ALBOPUNCTATA*, Schlechtendal. (Fig. 29.)



FIG. 29.
Aphilothrix albopunctata.

QUERCUS ROBUR, L. Bud. The well-known oak-, or King Charles', apple, is a spongy textured, whitish or rosy, almost spherical gall, occurring commonly on the terminal buds in May and June; it varies in size, from that of a pea to a

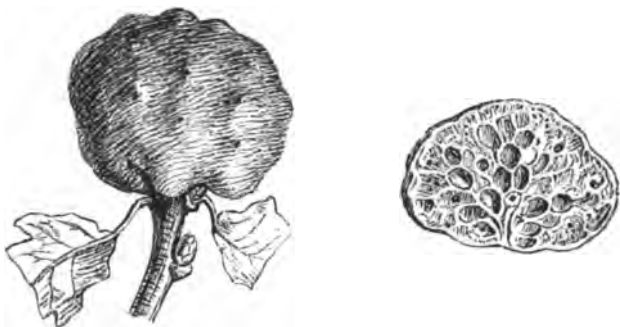


FIG. 30. *Andricus terminalis*.

medium-sized apple. The gall is many-celled, and is mature early in June, when the gall-flies emerge therefrom. **ANDRICUS TERMINALIS**, Fabricius. (Fig. 80.)

QUERCUS ROBUR, L. Bud. This gall has the appearance of a terminal swelling of the young oak shoots, but is truly a bud gall, although axillar buds and leaves are produced from its surface. In section the gall shows the surrounding woody growth, with an elongate apical cavity, at the base of which we find the single, brown, ovate larva-cell. The gall is mature in spring, and the gall-fly emerges therefrom in June. **ANDRICUS INFLATOR**, Hartig. (Fig. 81.)



FIG. 31. *Andricus inflator*.

QUERCUS ROBUR, L. Leaf. Small, reniform, green or red, succulent, but not soft, galls, occurring on the under side of the side veins and midribs of the leaf, from which, when mature, they are very easily detached. They occur in

numbers on a leaf, but each gall is single-celled. The galls are mature and fall from the leaf in autumn; the gall-flies emerge therefrom in June. *BIORHIZA RENUM*, Hartig (Fig. 32) [agamous form of *TRIGONASPIS MEGAPTERA*].

QUERCUS ROBUR, L. Leaf. Early in the year some oak leaves are occasionally noticed to curl up and become considerably shortened; if examined it will be noticed they have a spherical, smooth, green, pea-sized swelling at their base; frequently the whole leaf is galled, and two, three or more galls are confluent. In section this succulent gall exhibits a moderately thin walled cavity, which contains two thin, small, brown, cocoon-like larva-cells, separated by a very thin septum. Certain specimens of this gall might be taken for a bud-gall, but if closely examined the midrib of the leaf is generally

noticeable. The galls are mature in spring or early summer, and do not fall from the twig; the gall-flies emerge therefrom in June or July. *ANDRICUS CURVATOR*, Hartig. (Fig. 88.)

QUERCUS ROBUR, L. Leaf. The common cherry-gall of the oak is a succulent, spherical, smooth, green or rosy gall, of about the size of a cherry; it occurs on the under side of the oak leaf, generally singly, but sometimes three to five are found on one leaf. It is single-celled. gathered before mature the gall shrivels considerably;



FIG. 32. *Biorhiza renum*.



FIG. 33. *Andricus curator*.

it ripens in September or October, and the gall-flies emerge in late autumn. *DRYOPHANTA SCUTELLARIS*, Olivier, or



FIG. 34. *Dryophanta scutellaris* or *D. folii*

D. FOLII, Linné (Fig. 34) [agamous form of *SPATHEGASTER TASCHENBERGI*].

QUERCUS ROBUR, L. Leaf.

This gall is almost spherical, slightly depressed at the top and bottom, glossy, smooth, yellowish or reddish in colour, and occurs mostly in numbers on the under side of the leaf. It is about the size of a tick bean, and is single-celled, but the larva-cell is very large relatively to the size of the gall. This peculiarity and its much harder consistency distinguish it at once from the previous species, of which it is only about half the size, and is much more gregarious than *D. scutellaris* (*folii*). The galls occur in summer, and are mature in early autumn, but

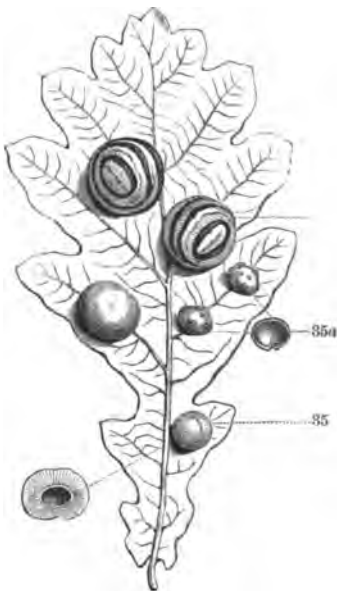


FIG. 35. *Dryophanta divisa*.

they do not become detached from the leaf. The gall-fly emerges from the gall in October and November. *DRYOPHANTA DIVISA*, Hartig (Fig. 85) [agamous form of *SPATHEGASTER VERRUCOSA*].

QUERCUS ROBUR, L. Leaf. Galls very similar to those last described are frequently found on the under side of the oak leaf, but only singly, and they are not smooth, but mostly covered with irregular nodules. In section they also exhibit very thin walls to the larva-cell, and are generally considerably smaller than the galls of *D. divisa*, and are not so brightly coloured. The gall is mature in early autumn, and the gall-flies emerge therefrom in October. *DRYOPHANTA AGAMA*, Hartig (see Fig. 85a), sexual form unknown.

QUERCUS ROBUR, L. Leaf. The common "silk-button" galls occur in numbers on the under side of the leaf, to which they are attached by a very minute foot-stalk; the gall is round, with a depression in the centre, and its surface is covered with



FIG. 86. *Neuroterus numismatis*.

smooth, silky, brown hair; hence its popular name from its resemblance to a brown, silk-covered button. When mature it has a diameter of about the eighth of an inch; it falls to the ground in the autumn, and the larva feeds and grows in the single larva-cell throughout the winter; the gall-fly leaves the gall in March. *NEUROTERUS NUMISMATIS*, Olivier (Fig. 86) [agamous form of *SPATHEGASTER VESICATRIX*].

QUERCUS ROBUR, L. Leaf. These galls occur in numbers on the under side of the leaf as almost flat, circular discs, yellowish in colour, but their upper surface is covered with short, reddish-brown, stellate hairs. They are commonly known as the "oak spangles." The galls fall from the leaf in autumn. When mature they measure about one quarter of an inch in diameter; the larvæ feed and change to pupæ during winter, and the gall-flies emerge from the galls in

March. *NEUROTERUS LENTICULARIS*, Olivier (Fig. 87) [agamous form of *SPATHEGASTER BACCARUM*].

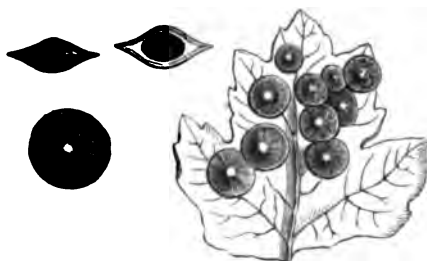


FIG. 87. *Neuroterus lenticularis*.

QUERCUS ROBUR, L. Leaf. This spangle-gall greatly resembles the common spangle-gall last described, but in shape it is raised from the surface of the leaf at its margins; it is reddish or purplish in colour, and does not generally occur in such immense numbers on a leaf. The gall-fly emerges from the fallen gall in March. *NEUROTERUS FUMIPENNIS*, Hartig (Fig. 88) [agamous form of *SPATHEGASTER TRICOLOR*].



FIG. 88. *Neuroterus fumipennis*

QUERCUS ROBUR, L. Leaf. Another closely-allied spangle-gall. It differs from the common species in shape, and in being smaller and of a more yellowish or cream-colour; it is a concave disc, with a small raised knob in the centre. The accompanying figures of an imaginary section of each of these three closely-allied spangle galls will help in their differentiation. In Fig. 89, *a.* represents *N. fumipennis*, *β.* *N. leviusculus*, and *γ.* *N. lenticularis*.

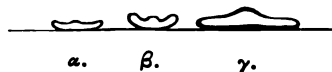


FIG. 89.

This species, like its congeners, emerges from the gall in March or April. *NEUROTERUS LÆVIUSCULUS*, Schenck (Fig. 40) [agamous form of *SPATHEGASTER ALBIPES*.]



FIG. 40. *Neuroterus laevisculus*.

QUERCUS ROBUR, L. Leaf. This small gall is attached to the mid or side ribs of the leaf on its under side. It is egg-shaped or oval, smooth, hairless, yellow or brownish, and often covered with bright red or purplish spots; when mature it is about one-tenth or one-eighth of an inch in length. The young gall is enclosed in a thin membrane, which splits lengthwise, and the scar on the leaf-vein is readily observable after the fall of the mature gall in early autumn. It is single-celled, with a relatively large cavity; the gall-fly emerges therefrom in November or December. *NEUROTERUS OSTREUS*, Hartig (Fig. 41) [agamous form of *SPATHEGASTER APRILINUS*].



FIG. 41. *Neuroterus ostreus*.

QUERCUS ROBUR, L. Leaf and male flowers. The common "oak currant" gall is a smooth, sappy, green (frequently more or less red on the catkin specimens), translucent, spherical gall of about the size of a large pea; it occurs on the under side of the leaf (where it is contexturate with it above, exhibiting a well-defined, convex, succulent swelling of the surface) and on the catkins, generally four or five specimens on a single leaf or catkin. It has a single larva-cell, which is small; the gall grows very quickly, and the gall-fly emerges therefrom

in June, just before the catkins fall. *SPATHEGASTER BACCARUM*, Linné. (Fig. 42.)

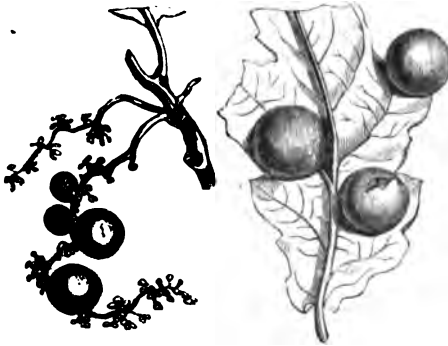


FIG. 42. *Spathegaster baccharum*.

QUERCUS ROBUR, L. Leaf. This gall resembles green leaf-specimens of the former species (*S. baccharum*) in every respect, except that its surface is thickly covered with fine, soft, whitish hairs. The gall is mature in early summer, and the gall-fly emerges therefrom in July and August. *SPATHEGASTER TRICOLOR*, Hartig. (Fig. 43.)



FIG. 43. *Spathegaster tricolor*.

QUERCUS ROBUR, L. Leaf. The small gall of this species occurs at the margin of the young leaf, generally near its base. It is smooth, oval, and yellowish, somewhat resembling a white mustard seed, except in shape (which is more oval). The gall, which is single-celled and thin-walled, is mature in spring, and the gall-fly emerges therefrom in June.



FIG. 44. *Spathegaster albipes*.

SPATHEGASTER ALBIPES, Schenck. (Fig. 44.)

QUERCUS ROBUR, L. Leaf. This inconspicuous blister-gall occurs as a circular swelling of the leaf on both sides. The mature gall is about one-eighth of an inch across, by about one-twentieth thick, and is yellow in colour, but is green, like the leaf, when immature; on the upper side radiate striations are frequently noticeable. The gall is mature in spring, and the gall-fly emerges therefrom in June. *SPATHEGASTER VESICATRIX*, Schlechtendal. (Fig. 45).

FIG. 45. *Spathegaster vesicatrix*.

QUERCUS ROBUR, L. Male flowers. In May and June we often notice, as it were, small locks of sheep's wool in the oak trees, where no sheep could get. These are the galls of *A. ramuli*. The gall is really a hard, woody, irregularly-shaped mass, consisting of many

FIG. 46. *Andricus ramuli*.

confluent larva-cells; but its whole small surface is covered with this thickly-matted, yellowish-white, woolly growth, so that the mass is often as large as a walnut or small apple. The gall is attached to a catkin; it is mature in June, and is many-celled, the gall-flies emerging therefrom in June and July. *ANDRICUS RAMULI*, Linné. (Fig. 46.)

QUERCUS ROBUR, L. Male flowers. Small, oviform, rarely almost spherical, smooth, but more or less deeply ribbed longitudinally according to their stage of maturity, brown, greenish-brown or reddish, succulent galls, occurring in some numbers on a catkin-stem; they are mostly sessile, but occasionally have a short footstalk, which rarely is found

considerably lengthened. The gall is single-celled, and when mature in June falls with the catkin, but the gall-fly does not emerge therefrom until the succeeding spring. *ANDRICUS QUADRILINEATUS*, Hartig. (Fig. 47.)



FIG. 47. *Andricus quadrilineatus*.

SALIX ALBA, L. Leaf. The bean-shaped galls on the leaf are very common, and generally well known. They are oval or bean-shaped, and occur four or five in a row on each side of the midrib (with which, however, they have no connection), but sometimes only singly; the galls are thick and fleshy, projecting both from the upper and under surface of the leaf, but more so from the under side; here they are generally green or whitish-green and pubescent, above they are bright red. Only one larva lives in a gall, eating the fleshy walls to a mere shell, when it bites a hole through and falls to the ground, where it pupates in a thick brown cocoon. The sawfly appears in May and September, being double-brooded. *NEMATUS GALLICOLA*, Westwood. (Fig. 48.)

The galls of this species occur commonly on *Salix fragilis*, L.; those on *S. Caprea*, which are similar, but not so



FIG. 48.

Nematus gallicola.

fleshy and thick, probably belong to a closely-allied, but distinct species.

SALIX ALBA, L. Leaf. The margins of the leaves are twisted and considerably thickened. This pseudo-gall is the work of the larva of *CECIDOMYIA CLAUSILIA*, Bremi. (Fig. 49.)

SALIX ALBA, L. Terminal leaves. The willow "rose-gall" is too well known to need detailed description, but it is more than probable that we have two or three closely-allied species whose respective galls are not clearly differentiated. The common form is the well-known tuft of terminal leaves or leaf-rosette which is so conspicuous an object at the end of the twigs of our common pollard and other willows, especially so on the bare twigs during winter. The gall consists of an imbricate mass of shortened, sessile, and crowded leaves; in the centre is a small, hard, inner gall, which contains one or more larvæ of the gall-gnat; the *Cecidomyia clausilia*. larvæ pupate within the gall in spring, and the imagoes emerge therefrom in May or June. *CECIDOMYIA ROSARIA*, H. Loew. Similar galls occur on *S. fragilis*, *S. Caprea*, and other willows.

SALIX CAPREA, L. Twigs. More or less globular, woody swellings of the twigs of this willow are frequently noticeable: these are commonly the work of the gall-gnat mentioned below, but more rarely of a sawfly; these latter most commonly occur on older twigs than the former. More than one larva occur in the galls; they pupate therein in thin brown cocoons in April, and the sawflies emerge therefrom in May and June. *CRYPTOCAMPUS PENTANDRÆ*, Retzius.

SALIX CAPREA, L. Twigs. The commonly found hard, woody, irregular, and variable swellings of the twigs of the willow and other willow species are the work of gall-gnats.



FIG. 49.

These galls are multilocular; the larvæ pupate in the gall, and the imagos emerge therefrom in May. *CECIDOMYIA SALICIS*, Schrank.

SALIX CAPREA, L. Leaf. Small, hard, pustular galls, occurring on the side veins of the leaf, often in considerable numbers; they are about the size of a small hemp-seed when single and mature; are conical in shape, projecting both on the upper and under side of the leaf; are hard and woody, and pale greenish in colour. The gall is single-celled, but we very commonly find large numbers confluent together; sometimes the gall takes the form of a much-thickened, hard midrib, extending the whole length of the leaf, and occupying half its extent; often yellowish or red in colour. Such galls are frequently left attached to the twigs during winter, and then show the numerous small round holes from which the larvæ have emerged; they leave the galls in autumn and pupate in the earth, the flies appearing in May. *HORMOMYIA CAPREÆ*, Winnertz.

SALIX CAPREA, L. Leaf. Round, hairy, green, rarely reddish, thin-walled, succulent galls, occurring on the under side of the leaf, attached only at one point, and showing as a discoloured spot above. In rare cases the gall is produced on the upper side of the leaf, and then is smooth and rosy. Each gall is tenanted by a single larva, which eats a small circular hole through, and quits it in September; it pupates in a cocoon in the earth, and the sawfly appears in May or June. *NEMATUS VIMINALIS*, Linné. (Fig. 50.)



FIG. 50. *Nematus viminalis*.

We probably have other "pea" gall-makers in the county, but these closely-allied *Nemati* and their distinctive galls are but indifferently known in this country. The sawfly "rosette" galls are also probably distinct from those above referred to, as occurring on *S. alba*, *S. fragilis*, &c.

POPULUS NIGRA, L. Leaf-stalk. The petioles of the leaves are swollen into pea-sized, hollow galls, which split when mature, and liberate the aphidious tenants. *PEMPHIGUS BURSARIUS*, Hartig.

POPULUS NIGRA, L. Leaf-stalk. The galls on the petioles are twisted into a spiral form, and are not so thick and discoloured as the above-mentioned species. *PEMPHIGUS SPIROTHECÆ*, Koch.

CONIFERÆ.

ABIES COMMUNIS, L. Bud. The "pine-apple" galls on our common spruce are best known in their old woody condition, as they remain on the tree for some time after the Aphides have quitted them. When fresh the gall resembles a small green cone, as it consists of a mass of short, fleshy, ovate, imbricate leaves at the base of a young branch; these enclosed cavities open when the gall is mature, and liberate the Aphides in early summer. *ADELGES ABIEIS*, Linné.

TAXUS BACCATA, L. Terminal leaves. At the end of a branch we often find a rosette of crowded and somewhat shortened leaves. The gnat larva lives within the bases of the leaves, and pupates therein in spring; the gall-gnats emerge from the "artichoke" galls in June. *CECIDOMYIA TAXI*, Inehbald.

GRAMINEÆ.

TRITICUM REPENS, L. Top shoot. In autumn or winter we find the imbricate, closely-sheathed leaves of a top shoot converted into a more or less cylindrical hard gall, which tapers towards both ends, attaining a length of from one to one and a half inch. In this country one of the parasitic Eurytomidæ (Chalcididæ) has been given as the gall-maker, which is undoubtedly a Dipteron, and is probably *LONCHREA PARVICORNIS*, Meigen.

SYNOPSIS OF SPECIES.

PART II. ENTOMOLOGICAL ARRANGEMENT.

HYMENOPTERA. CYNIPIDÆ.

RHODITES, Hartig.

- R. EGLANTERIÆ, Hart. Gall on *Rosa*. Common.
- R. ROSARUM, Gir. Gall on *Rosa*. Generally distributed, but not common.
- R. ROSÆ, L. Gall on *Rosa*. Very common.

AULAX, Hartig.

- A. GLECHOMÆ, Hart. Gall on *Glechoma*. Birdbrook, Burnham, Widford.
- A. RHOEADIS, Hart. Gall on *Papaver Rhœas*. Hockley.
- A. HIERACII, Bouché (*Sabaudi*, Hart.) Gall on *Hieracium*. Steeple Bumpstead, Danbury, Thundersley.

XESTOPHANES, Förster.

- X. POTENTILLÆ, Vill. Gall on *Potentilla*. Danbury, Epping Forest.

DIASTROPHUS, Hartig.

- D. RUBI, Hart. Gall on *Rubus*. Generally distributed, but not common.

ANDRICUS, Hartig.

- A. GEMMÆ, L. Gall on *Quercus*. Common.
- { A. GLOBULI, Hart. Gall on *Quercus*. Hadleigh, Hazeleigh, Hockley, Mundon.
- { A. INFLATOR, Hart. Gall on *Quercus*. Generally distributed, but not common.
- { A. RADICIS, Fabr. Gall on *Quercus*. Maldon, Rayleigh.
- { A. NODULI, Hart. Gall on *Quercus*. Common.
- A. SIEBOLDI, Hart. Gall on *Quercus*. Birdbrook, Maldon, Rayleigh, Thundersley.
- A. CORTICIS, L. Gall on *Quercus*. Maldon, Rayleigh.

- { A. COLLARIS, Hart. Gall on *Quercus*. Maldon, Rayleigh.
- { A. CURVATOR, Hart. Gall on *Quercus*. Common.
- { A. AUTUMNALIS, L. Gall on *Quercus*. Maldon, Rayleigh.
- { A. RAMULI, L. Gall on *Quercus*. Generally distributed, but not common.
- A. CALLIDOMA, Gir. Gall on *Quercus*. Maldon, Rayleigh.
- A. SOLITARIUS, Fonsc. Gall on *Quercus*. Maldon.
- A. QUADRILINEATUS, Hart. Gall on *Quercus*. Loughton, Maldon, Rayleigh, Woodford.
- A. ALBOPUNCTATUS, Schlecht. Gall on *Quercus*. Maldon, Rayleigh.
- A. OSTREUS, Gir. Gall on *Quercus*. Generally distributed, but not common.

CYNIPS, Linné.

- C. KOLLARI, Hart. Gall on *Quercus*. Very common.

TRIGONASPIS, Hartig.

- { T. MEGAPTERA, Panz. Gall on *Quercus*. Epping Forest, Mundon, Woodham.
- { T. RENUM, Gir. Gall on *Quercus*. Birdbrook, Burnham, Cricksea, Danbury, Maldon, Rayleigh, Widford.

BIOBHA, Westwood.

- { B. TERMINALIS, Fabr. Gall on *Quercus*. Very common.
- { B. APTERA, Fabr. Gall on *Quercus*. Maldon, Rayleigh.

DROPHANTA, Förster.

- D. FOLII, L. (*scutellaris*, Oliv.). Gall on *Quercus*. Generally distributed, but not common.
- D. DIVISA, Hart. Gall on *Quercus*. Generally distributed, and common.
- D. AGAMA, Hart. Gall on *Quercus*. Hockley, Maldon.

NEUROTERUS, Hartig.

- { N. LENTICULARIS, Oliv. Gall on *Quercus*. Very common.
- { N. BACCARUM, L. Gall on *Quercus*. Very common.

- { N. FUMIPENNIS, Hart. Gall on *Quercus*. Common.
- { N. TRICOLOR, Hart. Gall on *Quercus*. Rayleigh.
- { N. LÆVIUSCULUS, Schenck. Gall on *Quercus*. Maldon,
Rayleigh.
- { N. ALBIPES, Schenck. Gall on *Quercus*. Maldon.
- { N. NUMISMATIS, Oliv. Gall on *Quercus*. Very common.
- { N. VESICATRIX, Schlecht. Gall on *Quercus*. Maldon.

HYMENOPTERA. TENTHREDINIDÆ.

NEMATUS, Jurine.

- N. GALLICOLA, Westw. (*Vallismierii*, Hart.). Gall on *Salix*.
Very common.
- N. VIMINALIS, L. (*pedunculi*, Hart.). Gall on *Salix*. Generally distributed, but not common.

CRYPTOCAMPUS, Hartig.

- C. PENTANDRÆ, Retz. (*medullarius*, Hart.). Gall on *Salix*.
Maldon.

LEPIDOPTERA. TINEIDÆ.

LAVERNA, Curtis.

- L. DECORELLA, Steph. Gall on *Epilobium*. Generally distributed, but not common.

DIPTERA. CECIDOMYIDÆ.

CECIDOMYIA, Meigen.

- C. BURSARIA, Bremi. Gall on *Glechoma*. Birdbrook, Widford.
- C. ? CLAUSILIA, Bremi. Gall on *Salix*. Maldon.
- C. CRATÆGI, Wtz. Gall on *Cratægus*. Very common.
- C. GALII, H. Loew. Gall on *Galium*. Birdbrook, Maldon,
Rayleigh.
- C. FOLIORUM, H. Loew. Gall on *Artemisia*. Grays (W. F. Gwinnell). See 'Proc. Essex Field Club,' ii., pp. xvi., xx.
- C. PERSICARIE, L. Gall on *Polygonum*. Burnham, Canewdon, Cricksea, Maldon; Canvey, Foulness and Wallasea Islands.
- C. FLICATRIX, H. Loew. Gall on *Rubus*. Maldon.
- C. ? PRUNI, Kalt. Gall on *Prunus*. Maldon.

- C. *RANUNCULI*, Bremi. Gall on *Ranunculus*. Maldon.
 C. *ROSARIA*, H. Loew. Gall on *Salix*. Common.
 C. *ROSARUM*, Hardy. Gall on *Rosa*. Maldon.
 C. *SALICIS*, Schrank. Gall on *Salix*. Generally distributed,
 and common.
 C. *SISYMBRII*, Schrank. Gall on *Barbarea*, &c. Birdbrook,
 Romford.
 C. *TAXI*, Inchbald. Gall on *Taxus*. Greensted, Maldon.
 C. *TRIFOLII*, F. Löw. Gall on *Trifolium*. Maldon.
 C. *ULMARIE*, Bremi. Gall on *Spiraea*. Steeple Bumpstead,
 Maldon, Rayleigh, Woodham Walter, Widford.
 C. *URTICÆ*, Perris. Gall on *Urtica*. Very common.
 C. *VERONICÆ*, Vallot. Gall on *Veronica*. Birdbrook, Danbury,
 Loughton, Maldon.

DIPLOSI, Loew.

- D. *BOTULARIA*, Wtz. Gall on *Fraxinus*. Birdbrook, Maldon.
 D. *BUXI*, Lab. Gall on *Buxus*. Birdbrook.
 D. *LOTI*, DeGeer. Gall on *Lotus*, &c. Epping Forest, Maldon.

ASPHONDYLIA, Loew.

- A. *PIMPINELLÆ*, F. Löw. Gall on *Pimpinella*, &c. Maldon.
 A. *SAROTHAMNI*, H. Loew. Gall on *Sarothamnus*. Brentwood,
 Epping Forest, Mountnessing.

HORMOMYIA, Loew.

- H. *CAPRÆ*, Wtz. Gall on *Salix*. Maldon, Rayleigh.
 H. *CORNI*, Gir. Gall on *Cornus*. Helions Bumpstead.
 H. *FAGI*, Hart. Gall on *Fagus*. South Benfleet.
 H. *MILLEFOLII*, H. Loew. Gall on *Achillea*. Maldon.
 H. *PILIGERA*, H. Loew. Gall on *Fagus*. Danbury, Epping
 Forest.

- OLIGOTROPHUS TANACETICOLUS*, Karsch (possibly *H. Millefolii*,
 var.). Gall on *Tanacetum*. Maldon.

LASIOPTERA, Meigen.

- L. *RUBI*, Heeger. Gall on *Rubus*. Birdbrook, Burnham,
 Canewdon, Colchester, Maldon, Ongar, Rayleigh, Wid-
 ford, Woodham.

DIPTERA. MYCETOPHILIDÆ.

SCIARA, Meigen.

S. TILICOLA, H. Loew. Gall on *Tilia*. Maldon, Woodham
Mortimer.

DIPTERA. TRYPETIDÆ.

UROPHORA, Robineau-Desvoidy.

U. CARDUI, L. Gall on *Cirsium*. Maldon, Rayleigh, Canvey
and Wallasea Islands.

U. SOLSTITIALIS, L. Gall on *Centaurea*. Birdbrook, Danbury,
Rayleigh.

DIPTERA. MUSCIDÆ.

LONCHÆA, Fallen.

L. PARVICOENIS, Meig.? Gall on *Triticum*. Maldon, Rayleigh.

COLEOPTERA. CURCULIONIDÆ.

CEUTHORHYNCHUS, Schönherr.

C. ASSIMILIS, Paykull. Gall on *Sinapis*. Common.

C. SULCICOLLIS, Gyll. Gall on *Brassica*. Very common.

GYMNETRON, Schönherr.

G. BECCABUNGÆ, L. Gall on *Veronica*. Rainham (T. R. Billups).

MIARUS, Schönherr.

M. CAMPANULÆ, L. Gall on *Campanula*. Danbury.

MECINUS, Germar.

M. PYRASTER, Herbst. Gall on *Plantago*. Rainham (T. R.
Billups).

HEMIPTERA. APHIDIDÆ.

BRACHYCOLUS, Buckton.

B. STELLARIÆ, Hardy. Gall on *Stellaria*. Maldon.

SCHIZONEURA, Hartig.

S. LANUGINOSA, Hart. Gall on *Ulmus*. Generally distributed,
and common.

PEMPHIGUS, Hartig.

P. BURSARIUS, Hart. Gall on *Populus*. Generally distributed, but not common.

P. SPIROTHECÆ, Koch. Gall on *Populus*. Heybridge, Maldon, Rayleigh.

TETRANEURA, Hartig.

T. ULMI, DeGeer. Gall on *Ulmus*. Generally distributed, but not common.

ADELGES, Vallot.

A. ABIETIS, L. Gall on *Abies*. Common.

[The whole of the cuts of Oak-galls illustrating this paper were kindly lent by Messrs. West, Newman & Co. The Editor is indebted to Miss Ormerod for the cuts of *Cecidomyia Ranunculi* and *Ceuthorhynchus sulcicollis*. The remaining blocks were engraved expressly for this paper. —ED.]

**XIV. THE MAMMALIA OF ESSEX; A CONTRIBUTION TOWARDS
A LIST OF THE FAUNA OF THE COUNTY.**

By **HENRY LAVER, M.R.C.S., F.L.S.**

[Read December 17th, 1881.]

The Rev. Richard Lubbock, in commencing his account of the Fauna of Norfolk, remarks that a sketch of the Mammalia of a county "may be comprised within a narrow compass—species grow gradually scarcer and scarcer. When we look at the trim fences and high cultivation of great part of this district (Norfolk), a wide stretch of imagination is necessary to carry the mind back to days departed, when the urus, the bear, and the wolf ranged the forest, or traversed the marsh, pursued by hunters nearly as savage as themselves."¹ Our own county of Essex was, we are sure, the home of these same wild animals, the urus, the bear, and the wolf, and we may also place with them the wild hog, red deer, and roebuck, as creatures which have been the unfortunate victims of that rigorous cultivation mentioned above, which is found to be necessary to the sustenance and happiness of the higher creature, man. Cultivation and enclosure have been carried in Essex to greater completion than in most parts of England, and with the exception of Epping Forest there is no extensive tract of woodland in the county. Our wild and predaceous animals have in consequence been diminished or exterminated, earlier than in more favoured spots, where forests, mountains, and marsh have protected them and delayed that extinction which is inevitable before many years have expired.

It is, I think, a good idea to take stock, if I may be allowed the expression, of our diminishing fauna before the dying out of any more of our wild animals occurs; and in another

¹ ['Observations on the Fauna of Norfolk, and more particularly on the District of the Broads.' By the late Rev. Richard Lubbock, M.A., Rector of Eccles. Norwich, 1845. New Edition, 1879.—Ed.]

manner it may be useful, by directing attention to the various mammals remaining to us, especially as the class Mammalia is a branch of Natural History the study of which is almost entirely neglected in this country.

Ask any countryman, or even any well-educated person living in the country, how many species of mice there are in Britain, and not one in ten thousand will be able to answer the question. Even amongst those paying some attention to Natural History, nearly the same ignorance prevails; birds, butterflies, and moths, occupying their interest, generally to the exclusion of other and equally attractive subjects.

It is not surprising that the beautiful branches of Natural History are attractive to amateur students, but why is it that the mammals are so neglected? It may be that they are not found everywhere, as are butterflies and birds, and that they are more difficult to capture and preserve. On the other hand, these species are not so numerous, and any trouble and care expended on them will be quite as profitably employed as in the pursuit of more favoured creatures, for the study of Nature in her various forms is ever an unfailing source of pleasure to those whose minds are fortunately endowed with a taste for enquiry into her laws.

"I am not vain enough to suppose that I can add much to the zoological knowledge which is yearly becoming more general amongst us. Yet it is from local Faunas—from notes made by different observers in various districts as to the frequency or scarcity of species in the counties in which they reside—that the master naturalist must build up his system for a nation. The humblest attempt therefore is not without its portion of utility." These are the opinions of the Rev. R. Lubbock, in the preface to his *Norfolk Fauna*, and the words must serve as my apology for presenting the following remarks to my brother naturalists.

The order and classification adopted is that of the authors of the last edition of Bell's '*British Quadrupeds*,'¹ which is the standard work on the subject.

¹['*A History of British Quadrupeds, including the Cetacea.*' By Thomas Bell, F.R.S., F.Z.S., &c. Second edition, revised by the author,

CHEIROPTERA. VESPERTILIONIDÆ.

SCOTOPHILUS NOCTULA. The Great Bat.—This Bat, the largest of the British Cheiroptera, occurs here commonly. It is said to have a shorter period of activity than most of the order, but my experience is, that it comes out of its winter haunts in March if the season is favourable, and continues on the wing until late in October; it is to be seen flying over the river and this town, and in fact all through the valley of the Colne, in abundance, until quite the end of the month, in suitable seasons. The latest period at which I have obtained a specimen was on the 10th of November. I never find any other species hybernating with it; hollow trees appear to be its favourite resting-places, but I know a few spots where it may always be found resting between chimneys and the walls of houses. I think it is one of our most beautiful bats, the rich brown fur, smoother and finer than velvet, contrasting well with the black wings. In flight it is like the swift, rapid and high, and it well merits Gilbert White's name *altivolans*.^a

SCOTOPHILUS PIPISTRELLUS. The Common Bat.—This Bat, a small edition of the noctule, is here, as elsewhere, the

Robert F. Toms, and Edward R. Alston. London, 1874. In the original manuscript Mr. Laver had prefixed short specific diagnoses to his remarks upon each species, but the Editor has expunged these as being unnecessary: the generic and specific characters are admirably given in Bell's work, which should, of course, be in the hands of all students of our native Mammalia. A considerable amount of information on the habits and food of some of our mammals will be found in Mr. Harting's paper on "Forest Animals," 'Transactions,' i. 74.—Ed.]

^a[See 'Natural History of Selborne,' Letters XXII., XXVI., and XXXVI. Sir William Jardine remarks:—"The British fauna is indebted to White for the first notice of this species; it is locally distributed, and although not common generally is found in numbers together, so many as 185 having been taken in one night from the eaves of Queen's College, Cambridge. It was first described by Daubenton under the name of '*La noctule*,' which name Latinised was afterwards continued, and is prior to White's name of *Vespertilio altivolans*, which we regret has not been retained, as it is so characteristic of the habits of the species."—Ed.]

commonest of the order, appearing earlier and retiring later than any other, and it is the species most frequently seen by day. It is on the wing in mild seasons nearly up to Christmas, when it finally retires for its winter sleep, choosing almost invariably holes in and about buildings for its home. The flight, unlike that of its larger relative, is low, and well described by its common name, "Flitter Mouse"; the sheltered sides of buildings or hedges being favourite hunting-grounds, no doubt in consequence of its food, gnats and small insects seeking the same protection from the wind.

VESPERTILIO NATTERRERI. Reddish-grey Bat.—This easily distinguished species is reputed to be rare; in this district, however, it is one of our commonest bats. Houses and buildings are favourite hiding-places in summer; and in winter, cellars, caverns (as under Colchester Castle), and such places, are generally chosen. Occasionally bats are brought to me late in autumn, drawn up in the buckets of our deepest wells, and three out of four being of this species I have good reasons for believing that the crevices in the brickwork of the wells are occasionally chosen as *hybernacula*. I hear the peculiar note of this bat, during its evening flight, more frequently than any other in the streets and gardens of Colchester.

V. DAUBENTONII. Daubenton's Bat.—This also is not a rare bat in this district. It has one character by which it may be distinguished easily: the wing membrane extends only to the distal extremity of the tibia, leaving the foot free, instead of the membrane being continued to the root of the toes, as is usually the case in other species. Daubenton's bat has been well described as an aquatic species; its habit of haunting water, either stagnant ponds or running streams, flitting with rapid vibrations of the wings a very few inches from the surface, and apparently spending most of its time of flight there, makes the description "aquatic" a just one. Their usual habitats when at rest are in buildings. In winter I find them, as did Yarrell, under our castle at Colchester. Some that I have endeavoured to keep appeared

delicate, and soon died; perhaps they required aquatic insects, or it may be they could not bear confinement. The whole family appear equally unfitted for close confinement, and I find great difficulty in keeping bats alive for any considerable length of time.

V. MYSTACINUS. Whiskered Bat.—This, again, is much more common than is generally believed; I have no difficulty in finding all that I have required for the purposes of study. Its flight is very similar to that of the Pipistrelle; like that bat it hawks under the shelter of a hedge or row of trees, and I have no doubt is constantly passed over by those seeking it as the commoner species. Buildings appear to be its usual habitat.

PLECOTUS AURITUS. Long-eared Bat.—There is no difficulty in distinguishing this common bat: the remarkable ears, as long as the body, cause it to be unmistakable. There is no animal in existence, so far as I know, with ears in this proportion, except a long-eared bat, *P. homochrous*, which occurs in the Himalayas, and it is questionable whether this latter is a true species; if it is only a variety, then the animal under consideration is, in respect of ears, unique. Although the ears are so large, they do not strike one as being so disproportionate as those of the lop-eared rabbit, which are really small by comparison. *Plecotus auritus* is very common in the Colchester district, and usually has its haunts in buildings, although I have had them brought me from hollow trees. It is a mild and gentle creature, and not difficult to tame. It is the bat most frequently caught in houses, having entered the room by the open window, often much to the consternation of female members of the household.

BARBASTELLUS DAUBENTONII. The Barbastelle.—I have found this bat early in April flitting slowly, and in an apparently purposeless manner, near the ground, under the protection of a plantation; and this style of flight is one means by which it may be distinguished. Its dark colour makes it appear much larger than it really is; and now that I have learned to recognise it I do not consider it so rare as

it is usually believed to be, although I cannot call the *Barbastelle* a common bat. The ears of the preceding species were remarkable for their size: these for the manner in which they are united across the forehead of the animal; and this is a character which assists us to recognise it, especially if we bear in mind that this bat's fur is darker than that of any other British species. It is very solitary in its habits, and haunts trees principally. I have never seen it except away from the town, and I find it useless to search for where I have seen it flying the previous night.

CHEIROPTERA. RHINOLOPHIDÆ.

RHINOLOPHUS FERRUM-EQUINUM. Greater Horse-shoe Bat.—This bat is stated—in both editions of ‘*Bell's Quadrupeds*,’ and also in ‘*Cassell's Natural History*’—to occur at Colchester. I believe that some mistake was made by Yarrell with regard to the locality of his specimen; the animal is so distinct in flight, and so unmistakable in the hand, that I do not think I am in error in affirming that neither of the horse-shoe bats occurs in this district. They are plentiful in the western counties, and I know many places in which I have seen both species in abundance.

INSECTIVORA. ERINACEIDÆ.

ERINACEUS EUROPEUS. Hedgehog.—This well-known animal is common everywhere, in spite of the constant persecution of game preservers. There can be no doubt it occasionally helps itself to an egg, or a young partridge or pheasant; but its depredations in this respect are quite compensated for by the good it does in destroying grubs, slugs, and insects. Taken altogether it may be considered as a very harmless and useful little creature. I know no animal that so soon becomes tame and familiar when in confinement.

INSECTIVORA. TALPIDÆ.

TALPA EUROPEA. Common Mole.—This useful animal is very common in all parts of the county, although in every district it is subjected to great persecution, as the farmers

object to its burrowing and casting up mounds in their pastures and newly-sown fields. I am not aware of any other mischief done by this creature in Essex, except, it may be, that it disarranges and blocks up the land-drains by burrowing under them. In other parts no doubt considerable mischief has arisen by this industrious little miner boring through embankments made to keep out water, necessitating every means being taken to keep down its numbers. The hillock which covers the nest of the mole is generally made in a hedge or wood, but sometimes in the open field; it may usually be known by its size being so much greater than the ordinary "mole-hill." The young are from three to six in number, and are produced in the spring; they are born naked, but grow very rapidly. When young they are able to fast a considerable time; I have had some brought me alive that were taken out of the nest the day before, and of course had been without food for many hours, a privation which would have been speedily fatal had they been full-grown. I have purchased of one mole-catcher (who works in company with his brother) in one season fifteen hundred fresh skins; and this will give some idea of the enormous number destroyed by an able man. There is in this district a family of mole-catchers, the greatest masters of their art I have ever known: at any time they will produce living specimens on having a few hour's notice. Their name is "Watch'em" (watch them), a nick-name no doubt given them in consequence of their trade. They are hereditary mole-catchers, the family having followed this trade for more than 150 years.

INSECTIVORA. SORICIDÆ.

SOREX VULGARIS. Common Shrew.—The colour of this animal varies very much, hardly two specimens being of exactly the same shade. It occurs commonly in all parts of the county, but is more frequently heard than seen: like all the rest of the family it is very pugnacious, rarely two meeting without a fight resulting, and their shrill war shrieks are often audible in hedge or coppice as evidence of these encounters.

SOREX PYGMÆUS. Lesser Shrew.—There can be no doubt of the specific distinctness of these two shrews (*Sorex vulgaris* and *S. pygmaeus*), and the most easy character to distinguish them is the comparative length of tail. I find them both equally common, either as captured specimens or as dead on the paths in autumn. The colour of the tips of the teeth is not an important point, as it varies much with age; but I think the hair on the lower parts of *S. pygmaeus* will be generally found to be a clearer white than is the case in *S. vulgaris*.

SOREX FODIENS. Water Shrew.—This interesting little animal occurs in all parts of the county in suitable localities, usually preferring shallow stagnant waters to quickly running streams; but it is found occasionally at some distance from water. It is amusing to watch its hunting for food in the half-dry marsh ditches, and I have seen it very commonly in those about Paglesham and Wallasea Island. It is an expert swimmer, but seems to prefer running about underneath the water, and this it does as freely and with as great apparent comfort as on dry land, using its long snout to turn over any substance which may hide its prey. Its food consists principally of beetles, their larvæ, and other insects, as well as fresh-water Crustaceans.

Sorex remifer (the Oared Shrew), formerly considered distinct, is only a dark specimen of *S. fodiens*, according to the latest authorities.

CARNIVORA. URSIDÆ.

MELES TAXUS. The Badger.—This animal, so well known to most of us by the accounts we have heard from persons of a previous generation, is well-nigh extinct in this country, where fifty years since it was very common: clearance of woods, diminution of hedges, and excessive game preserving, are the most effective causes of this extermination; and game preserving, as now carried on, will, I fear, not only blot out the poor badger, but every other animal called *vermin*, by ignorant game-keepers and their masters, whether useful or not. Within the last year two badgers have been

taken in the Colchester district, and quite recently one was caught between Colchester and Harwich, at Bentley; but these individuals were, I fear, our last survivors of a race which gave much sport to our ancestors, or, perhaps we should say, gave opportunity for the exhibition of much brutality. In my younger days I saw a few baitings, but it certainly did not strike me that any great amount of suffering was inflicted on the badger; the dogs, especially those new to the work, gave unmistakable evidence that they did not like the badger's jaws.

CARNIVORA. MUSTELIDÆ.

LUTRA VULGARIS. Common Otter.—This animal also, in Essex, is becoming rare, not on account of the value of our coarse fish on which it lives, but in consequence of the ease with which it may be taken in a steel trap, and so be made into a "specimen" to adorn the hall wall,—a horrible "stuffed" effigy of its former graceful self. It has occasionally appeared lately in the Colne River, close to this town, and several have unfortunately been destroyed at Ford Street. It occurs also in the Stour, Chelmer, Blackwater, and Lea. It is certainly one of our most interesting and graceful animals when swimming in its native streams. It is astonishing that so large an animal is able to slip into the water so quietly, not making half the wake that a rat does; but so it is, and anyone who is fortunate enough to see a mother and family playing in clear water, as I have more than once, will I am certain agree with me that it is one of the most interesting sights possible. Otters are usually nocturnal in their habits, like the rest of the family, and I have heard an old gentleman say that when the ground was covered with snow he tracked an otter for miles in its passage from pond to pond where it had travelled during the night. This occurred in Dengie hundred, at a time when ponds containing fish, or at all events eels, were much more common than now, and when almost every field had its pond.

MUSTELA VULGARIS. Common Weasel.—A character sufficient to enable one at a glance to distinguish this animal from the stoat is afforded in the coloration of the *tail*, which

is of the same reddish brown tint as the upper surface of the body. An additional distinction is found in the usually smaller size of the weasel, a character, however, which is not invariable, as I have seen weasels quite the average stoat size, and full-grown stoats as small as undersized weasels. This is another of the so-called "vermin," and the weasel is destroyed whenever met with,—a great mistake, in my opinion, as its prey consists principally of the smaller mammals. Its food is not, however, confined to these, as I have found beetles, lizards, slow-worms, and other small fry in the stomachs of those I have examined. I believe it is very rare for the weasel to interfere much with game; and even if it did much damage in this respect, it could never cause half the jealousies, quarrels, and miseries produced by the excessive preservation of game. In some parts of England it is, when small, called a "mouse-hunter," and well it deserves this name. When chasing a mouse it keeps to the scent as well as the best fox-hound, and seems quite regardless of onlookers. I have said "keeps to the scent;" perhaps I ought to have said it never passes over the scent, even when in full gallop. The manner of its chasing a mouse, in all cases that I have observed, is by making casts diagonally across the mouse's track; and this plan of hunting, I have an idea, is not confined to the weasel. In spite of persecution this little animal is common in all parts of Essex, on the marshes especially so; and there I have found evidences in casts that it is not unfrequently eaten by herons.

MUSTELA ERMINEA. The Stoat.—This bloodthirsty, active, and destructive member of a specially bloodthirsty family, is very common throughout Essex, persecution on all sides appearing to have little influence on its numbers. Its food and habits are similar to those of the weasel, but I fear I cannot defend it from the charge of being very destructive to game. Although mice and such small creatures contribute to its sustenance, still I think the larger mammals, as hares, rabbits, and rats, are its favourite prey, which it chases by scent, as most who have lived in the country will have had opportunities for observing. Hares and rabbits, after being

chased for some distance, appear to resign themselves to their fate without further efforts to escape; whether they are paralysed by fear or exhaustion, or both, I am not sure, but they certainly sit still and allow the little hunter to attack them without attempting to defend themselves except by screams. In winter, in this country, I have often observed the change to white to have occurred, but more frequently the change is not complete, some red marks still remaining on the head or shoulders. The number of young is about four or five, and more playful little creatures than a family of young stoats it would be difficult to find.

MUSTELA PUTORIUS. The Polecat.—This destructive animal, both to poultry and game, is becoming very rare in Essex, in many districts being quite extinct, even in spots where a few years since I remember it as being pretty frequently met with. There is very little difference in appearance between the dark ferret and the polecat, and the probability is that the ferret is simply a domesticated polecat, but domesticated in a warmer climate than ours; and this, no doubt, accounts for the greater susceptibility to cold in the domesticated animal. A part of this tenderness is doubtless due to the warmer conditions under which ferrets are reared; for I always found my ferrets, which were reared in an open pig-stye, were not the shivering creatures one usually sees, and I often observed them tumbling and rolling in the snow apparently without discomfort. The food of the polecat is as varied as is that of the other members of this family, and also includes fish, frogs, and other reptiles, according to some authorities.

MARTES FOINA. Common Marten.—This very graceful creature is now I fear extinct in Essex,⁴ but as it is exclusively nocturnal it may have escaped notice. In its habits it differs from the other members of this family, they almost universally confining their hunting manœuvres to the ground; but the marten climbs trees with more than the agility of the

⁴ [The last recorded Essex specimen of the Marten was killed in Epping Forest in 1853. See 'Transactions,' i. 95.—ED.]

squirrel, and preys principally on birds, which it surprises when roosting. It also differs in not giving out the disgusting odour we usually associate with this family, and which has, amongst our native members, its greatest development in the polecat. Accounts of captures of martens are very unsatisfactory, as we cannot feel sure which of our two native species (if species they are) is referred to; but I think the species under consideration is the one intended by Lubbock in his 'Fauna of Norfolk,' first published in 1845. He says "it still is occasionally found in Essex."

CARNIVORA. CANIDÆ.

VULPES VULGARIS. Common Fox.—It is quite unnecessary to give any specific account of this fortunately common member of our fauna, as it is so well known by sight to almost every one. I say "fortunately common," and may it long remain so, being the object of a sport which does so much to bring all classes together, encourages the breeding of horses, trains our young men as fearless riders, and does not make its votaries selfish and suspicious, as is the case in shooting, fishing, and most other sports. As far as I know the pursuit of the fox and its preservation are the causes of no damage to anything except a little poultry and game; but the advantages are so manifest that we must be content to give these in exchange. So long as there are woods in the country, and the present condition of agriculture gives no reason to suppose they will be destroyed, so long will there be foxes, unless the game preserver takes to using strychnine, and so destroys the sport of the many for a day or two's grand battue during the year; but I hope we may never see this. Many anecdotes are related of the sagacity of this animal, but I need not go into them, as the fox's cunning is proverbial.

CARNIVORA. PHOCIDÆ.

PHOCA VITULINA. Common Seal.—This seal occurs sparingly on all parts of the coast, but it is not seen every year, and in fact the seals that have been taken on the Essex shores can

only be considered as stragglers. It has been killed in the Blackwater, in the mouth of the Thames, and elsewhere; but one great difficulty and source of error in consulting records of the capture of Phocidæ is that one can rarely be certain of the species, in consequence of the specimens having seldom been examined by competent naturalists.

CYSTOPHORA CRISTATA. Hooded Seal.—In 1847 a specimen of this seal was taken in the Orwell, and is now preserved in the Ipswich Museum. As the Orwell empties into Harwich harbour I think we are entitled to place this animal in our Essex fauna, although its normal habitat is within the Arctic circle. The above two species are the only seals that I am able to give as visiting the Essex coast without any doubt, but I do not see why the Grey Seal (*Halichærus gryphus*) should not occur, as one of its breeding-stations, the Farne Islands, is on the Northumberland coast; it is a common species in the Hebrides and Shetland, and has been taken in the Isle of Wight.

RODENTIA. SCIURIDÆ.

SCIURUS VULGARIS. Common Squirrel.—This elegant and active little animal is so well known that very little need be said about it. It occurs in all parts of the county in suitable spots—that is, where there are woods. It is almost omnivorous in its tastes; birds' eggs and insects are occasionally eaten, but vegetables are its main support. In the early spring, when the beech is coming into leaf, I have noticed as many as six squirrels busily feeding in one tree on the young shoots, biting off and throwing down the leaves, and only consuming the stalk—that is, the young branch. In the autumn I have seen squirrels strip off the loose bark from dead branches, and carefully scrape out with their teeth the fungus frequently found in such situations. Whenever I have seen this going on I have noticed the position adopted for feeding is not the usual one; instead of sitting on its haunches, the squirrel almost invariably hangs head downwards. It is said to hybernate, but I much question whether it does so as a rule. It may occasionally take a prolonged sleep, but

I never knew the weather so cold that I could not find a squirrel on the move, if it were properly looked for.

RODENTIA. MYOXIDÆ.

MYOXUS AVELLANARIUS. Dormouse.—The Dormouse occurs in those parts of Essex where oaks and nuts flourish, and where there is sufficient woodland or overgrown hedges to protect it. It was formerly very common on the roadside at Berechurch, but after the severe winter of 1860 the numbers were greatly diminished. I found many nests in the bushes with dead occupants. This creature is one of the best examples of a hibernating quadruped in this country, and as a rule I think the winter sleep is taken underground, the bush nest not being used for that purpose; at all events in many instances I find them deserted. If the mouse is disturbed in its bush nest, it is extraordinarily quick in its movements amongst the boughs, making a great contrast to the apparently stupid sluggish creature one usually sees in confinement. The food of Dormice is very similar to that of squirrels, but I have occasionally taken them devouring the "sugar" I had placed on tree trunks for the purpose of attracting moths at night.

RODENTIA. MURIDÆ.

MUS MINUTUS. Harvest Mouse.—This very beautiful and active little creature occurs in all parts of Essex, in the winter time being found in corn-stacks, especially those placed in the fields, and I think most frequently in oat-ricks. I never discovered more than a dozen in one rick, although others have informed me that they have been found abundantly in such situations. As a pet it is very interesting, and rarely quiet day or night. They are very peaceable all through the winter, and any number may be kept together, but in the spring fighting goes on until all, or nearly all, the males are destroyed and eaten, for they are dreadful cannibals. But on the whole I can strongly recommend them as pets; they are sweet, not at all mousy in odour, and very amusing in their ways. The longest time I have had them in con-

finement is over two years, but I never could make them so tame as my pets of the next species (*Mus sylvaticus*). In-doors they do not become torpid, nor when living in corn-ricks. I have never found any young in corn-ricks, although they are said to breed there, and I consider their breeding-season is entirely confined to the summer months. This habit perhaps helps to prevent them becoming the pests some of the other mice undoubtedly are to the farmer and gardener.⁵

MUS SYLVATICUS. Wood Mouse.—This gentle little creature and delightful home pet is one of the most destructive of its race; in fields, gardens, or plantations, newly sown peas or corn, or recently planted bulbs or shrubs, are especial objects of its attention. It is rarely found in houses, barns, or ricks, preferring much the shelter of a hedgerow or wood. I generally have some of these mice in confinement, and they are very friendly one with the other, so that as many as you please may be kept together, even if they are quite strangers. This herding together seems natural to the Wood Mouse, fourteen or fifteen, and even more, may sometimes be dug out of one burrow. They seem also to work together in storing provisions, the bunches of growing barley or other corn showing plainly where the storehouse has been; but nothing in the way of vegetable food seems to come amiss to this very abundant mouse. Albinos are occasionally taken, and the colour of different specimens varies considerably in shades of red. Of all our native mice this is most easily tamed; an occasional specimen is more than usually friendly, and may be made to come into the hand within a month of capture. I have never succeeded in rearing the young of either this or the harvest mouse in confinement.

⁵ [This little animal, with the exception of *Sorex pygmaeus*, the smallest British mammal, was first noticed as an inhabitant of this country by Gilbert White (Letters X. and XII.) He gave Pennant a description of the tiny nest in his own inimitable style, and adds, "This wonderful procreant cradle, an elegant instance of the efforts of instinct, was found in a wheat-field suspended in the head of a thistle."—ED.]

MUS MUSCULUS. Common Mouse.—Who does not know this foul-smelling, but nevertheless pretty little beast? It abounds everywhere, and has followed man to all parts of the world. Houses, buildings, and corn-ricks are its favourite haunts, and it does not occur in this country except in their vicinity. Its original home certainly was not in Britain.

MUS RATTUS. Black Rat.—This, our oldest rat, was abundant before the advent of the Brown Rat, called by Walton and others the "Hanoverian." It is now almost extinct, but still occurs about the docks and East End of London. These may not be native examples, and probably the race is kept up by escapes from the vessels in the docks in the neighbourhood. The Black Rat is easily known from the Hanoverian Rat by the slenderness and length of the tail, and by the mouth appearing to be so far under the nose. In habits and feeding there is much in common between the two species, but *Mus rattus* in buildings confines itself to the upper parts and roof, and *Mus decumanus* to the basements and drains.

MUS DECUMANUS. Hanoverian or Norway Rat.—This pest, although placed amongst our native animals, did not make its appearance in England until the earlier part of the eighteenth century, doubtless brought hither by means of merchant vessels from some southern country. Pennant says from the East Indies,* and he remarks with prophetic intuition, "It has quite extirpated the common kind (*Mus rattus*) wherever it has taken up its residence; and it is to be feared that we shall scarcely find any benefit by the change—the Norway rat having the same disposition, with greater abilities for doing mischief than the common kind." At the time when the name "Norway Rat" was applied to it, it was not known in Norway at all. It was called the "Hanoverian

* ["I suspect that this rat came in ships originally from the East Indies; a large brown species being found there called *Bandicotes*, which burrows underground. Barbot (Churchill's Coll. Voy. 214) also mentions a species inhabiting the fields in Guinea, and probably the same with this." Pennant, 'British Zoology,' i. 117, (4th Edition, 1776.)—Ed.]

Rat" from its having arrived in this country about the same time as the Hanoverian Sovereign; no doubt this was a witticism of our Jacobin fellow-countrymen. Its fecundity, cunning, and omnivorous habits enable it to defy all efforts made to extirpate it, and the destruction wrought by game-preservers on so-called vermin, by getting rid of its natural enemies, is a great help to its continuous abundance in many districts. In the light soils of this neighbourhood (Colchester) every hedge has its colony, especially where game-preserving is carried out. There are few animals that fight more desperately for life when driven into a corner; all fear seems entirely to have forsaken the unfortunate beast, which appears determined to sell its life as dearly as possible, and few of its natural enemies will attack the Hanoverian Rat under these circumstances. I never saw cats even attempt it, they preferring to seize the rat whilst running; and almost every cat has its own peculiar method of doing so. One I remember, always with her foot turned the rat over on its back, caught it by the throat, and at the same time fell on her side and gave one violent kick; the result was immediate death to the unfortunate rat. Other cats throw them over their heads after having bitten them through the heart, and others again simply hold them in their mouths until the rats are dead. But in what way soever the cat seizes them she always takes care to avoid their formidable incisor teeth, and at the same time drives her canines into some vital spot. The town rat is very cautious and most difficult to trap, and his country cousin quickly takes warning after a few have been caught, and most adroitly avoids all snares and gins in the future.

RODENTIA. ARVICOLIDÆ.

ARVICOLA AMPHIBIUS. Water Rat.—Bell, quoting Waterhouse, says, "The animals comprising this family (Arvicolidæ) have all the essential characters of the Muridæ, but differ in having rootless molars and in the form of the lower jaw." There are other characters given, but rootless molars seem

the great and easily distinguishing feature separating Muridæ and Arvicolidæ. The Water Rat, for its size and numbers, does less damage to man than any other member of the family, its principal food being aquatic vegetables, and it only takes what man can well spare. Occasionally, when they are abundant and the weather is severe, they do a little mischief to osier beds, but the injury they inflict on the farmer is so small as not to be worth consideration. The little animal is common in all parts of Essex, wherever there are sluggish streams or stagnant water in sufficient quantity to hide it. It will be well to bear in mind that it is sometimes quite black in colour, and has been described (by Macgillivray, 'Nat. Lib.' xvii. 257) under the name of *Arvicola ater*, but this is merely a variety. This dark variety has occasionally been mistaken for the old English Black Rat (*Mus rattus*), and many of the supposed appearances of the latter animal can thus be explained.

ARVICOLA AGRESTIS. Common Field Vole.—Bell says that *A. agrestis* may always be distinguished by the character of its second upper molar, which has five cemental spaces, whereas the same tooth in *A. arvalis* (which has not yet been found in Britain), as in all the other European voles, presents four spaces. This vole abounds sometimes to such an extent as entirely to destroy the herbage, and from the quantity it consumes (in confinement I have known one eat six drachms of clover in twenty-four hours) one can quite understand the devastation caused by it when existing in numbers. Not only is herbage eaten, but, according to Bell, "many years since the plantations of young oaks in New and Dean Forests were destroyed." Its insatiable appetite compels it to be abroad at all seasons of the year and all hours of the day, but I have noticed those I have kept in confinement to be more active towards and during the evening. I never could make them very tame, and they appeared to me to be rather stupid. The nest is usually placed amongst the roots of the grass, sometimes under fallen timber. The young are from four to six in number, and there are generally three or four broods in a year. Weasels, owls, and kestrels are their

greatest enemies, the Short-eared Owl (*Otus bruchyotos*) being a great destroyer of them.⁷

ARVICOLA GLAREOLUS. Red Field Vole or Bank Vole.—This vole is by no means common in Essex, according to my experience, although the first recorded specimen as British was described by Yarrell from an Essex example (‘Proc. Zool. Soc.’ 1882). I have seen a specimen from West Bergholt and another from Layer-de-la-Hay, and I daresay more might be found if observers would carefully examine those voles they meet with. The habits of *A. glareolus* appear to be similar to *A. agrestis*, but I think they are never found in such damp situations as the Field Vole. The only character to be entirely depended on to distinguish them is in the teeth. Colour, length of tail, and brush at the end of tail are uncertain marks in such a variable family, so that I would advise no one to trust any of these singly in the identification of specimens.

RODENTIA. LEPORIDÆ.

LEPUS TIMIDUS. Common Hare.—I shall say little about this animal, as it must be so well known to everyone. It occurs in all parts of the county, and is, from its manner of feeding, a great pest to the corn-grower and gardener. Hares vary much in weight: in this county from seven pounds to

⁷ [A passage occurs in the last edition of Yarrell’s ‘British Birds’ which illustrates these observations of Mr. Laver. Speaking of the Short-eared Owl, the author remarks (Vol. i., 165):—“But undoubtedly field-mice, and especially those of the short-tailed group, or voles, are its chief objects of prey, and when these animals increase in an extraordinary and unaccountable way, as they sometimes do, so as to become extremely mischievous, owls, particularly of this species, flock to devour them. Thus there are records of “a sore plague of strange mice” in Kent and Essex in the year 1580 or 1581, and again in the county last mentioned in 1648. In 1754 the same thing is said to have occurred in Hilgay, near Downham Market, in Norfolk, while within the present century the Forest of Dean, in Gloucestershire, and some parts of Scotland, have been similarly infested. In all these cases owls are mentioned as thronging to the spot and rendering the greatest service in extirpating the pests.” ‘History of British Birds,’ by William Yarrell. 4th Edition. London, 1872.—ED.]

eight pounds is the average, but I once saw a female turn the scale at ten pounds and a half.

LEPUS CUNICULUS. The Rabbit.—This destructive creature is very common in all parts of Essex, and requires little to be said about it; its food, habits, and appearance being familiar to all dwellers in the country. But it may not be so well known that occasionally specimens occur which in colour are quite black, and this without, as I believe, any admixture of tame blood.

RUMINANTIA. CERVIDÆ.

CERVUS ELEPHAS. Red Deer or Stag.—I fear this beautiful animal must be considered extinct in this county, unless there should be a lingerer in Epping Forest, where Bell in his 'British Quadrupeds' says a few were found down to the present century.*

CERVUS DAMA. Fallow Deer.—This animal was very early introduced into Britain, of which it is not therefore a true native; but as it exists in many parks in this county in a semi-domesticated condition, I have thought fit to introduce it into the list of our fauna. I see occasional mention of deer in Epping Forest; this species is the one probably meant. It is to be hoped that the managers of this lovely haunt of the Londoners will take steps to protect the few there, and so add to the attractions of the woods.†

CETACEA.

The order Cetacea is one of the most difficult divisions of Mammalia for practical study, especially for naturalists who

* [Red Deer existed in Epping Forest as late as the year 1827. See 'Proceedings,' i. xlvii.—ED.]

† [The Fallow Deer still lives in the Forest in a wild state in very considerable numbers, and the specimens exhibit abnormal characters, perhaps the result of long isolation and inter-breeding. Mr. Harting is studying the subject, and he has promised to bring it before the Club at no very distant date.—ED.]

are not able to make excursions to those seas where the different forms are most common. The discrimination of species is rendered additionally puzzling in consequence of each author on the subject adopting a classification and nomenclature of his own, or at all events giving names to varieties which other students may consider to belong to the typical species. In the foregoing orders of Mammalia I have been able to give the results of my own observations, but here, of course, I must depend on records only, and shall claim as belonging to our Essex fauna any cetaceans taken in our rivers or on our coasts. Many of these records are quite useless from the want of a correct description of the animal. The terms "Bottle-nose," "Fin-back," and so on, being evidently often very loosely and inaccurately applied, and of no assistance in identifying the true name of the captures, I have been obliged to pass over many observations from inability to recognise the species recorded. As might be expected from its size, the River Thames appears to have been very productive in species, and the records are the more valuable as the species have generally been identified by competent naturalists, as a result of the ease of access to London.

MYSTACOCETI. BALÆNOPTERIDÆ.

BALÆNOPTERA MUSCULUS. The Rorqual.—This whale, one of the largest animals, has occurred on our coasts several times. One was taken in the Thames in May, 1859; and in the 'Zoologist' for 1849, p. 2620, is recorded the capture of a "finner whale" at Grays, of the length of 58 feet, and a girth of 80 feet: judging by these dimensions it was probably an example of this species.

B. ROSTRATA. Lesser Rorqual.—This is one of the best marked and most easily distinguished species of the family, and at the same time one of the most common on our coasts. It has occurred in the Thames several times, John Hunter describing, in the 'Philosophical Transactions' for 1787, one from this river; another was also recorded and figured in the 'Zoologist' for 1848, p. 89, and is now preserved in the British Museum.

ODONTOCETI. PHYSETERIDÆ.

PHYSETER MACROCEPHALUS. *Sperm Whale.*—This tropical whale has occasionally wandered to the shores of this island; and it is recorded that in 1788 six were found dead on the Kentish coast, and a live one ran ashore in the Thames at the same time. Dale also mentions one caught in the Thames, and brought ashore at Blackwall.

HYPEROODON ROSTRATUS. *Common Beaked Whale.*—This is the best known species of the family of ziphioid whales, which are distinguished by possessing one or two pairs of teeth, situated in the lower jaw only. It appears to come into British waters regularly in the autumn, and specimens are killed almost every year on some parts of the coasts of this island. John Hunter records one captured in the Thames above London Bridge in 1783; and another, no doubt of this species, is figured in Dale's 'History of Harwich and Dovercourt,' as having been captured in the Blackwater estuary.

ODONTOCETI. DELPHINIDÆ.

ORCA GLADIATOR. *Grampus.*—John Hunter records the capture of three specimens of this savage and destructive animal in the River Thames towards the end of the last century; and in the British Museum is the skull of a specimen taken on the Essex coast, as recorded in the 'Zoologist' for 1873, p. 8429. Some years since I saw two whales, which had been killed in one of the creeks of the Blackwater, which I have no doubt were of this species, but no record was kept of them, and I do not recollect what became of their bones; probably, as usual, they went for manure.

PHOCÆNA COMMUNIS. *Porpoise.*—Who does not know this merry and active creature? It occurs everywhere on our coasts, and is as frequently seen during stormy weather as at any other time, apparently revelling in the tempestuous waters. It is so common that I have not thought it necessary to give any records of capture.

DELPHINUS DELPHIS. *Common Dolphin.*—I have not been able to find a record of the occurrence of this common

cetacean on any part of our Essex coast; but I feel certain that it ought to be in our list. Perhaps someone with better opportunities than myself will be able to give an instance of its capture.

D. rursio. Bottle-nosed Dolphin.—This generally reputed rare animal has occurred twice within my own observation. One occurred a few years since off Harwich, the specimen being about 10 feet long; and the other was shot in the Colne a few months since, as I recorded in the 'Zoologist' for 1882, p. 147. This specimen, like the last, was a female, and was about 8 feet long. In 1829 one was taken in the Thames below the Nore, and its skeleton is in the museum of the College of Surgeons. In most of the drawings of the skull of this animal the teeth are represented as truncated; this is no doubt the result of wear, and is incidental to age; but in both those individuals examined by me the teeth were sharp, and slightly directed inwards and backwards. The stomachs, in both cases, were empty, except that they contained a large number of the ear-bones (otoliths) of the Gadidæ: I recognised those of cod, haddock, and whiting. I fancy this is one of the most easy to kill of the family; I have known one caught by a cod-hook in the lip and killed; and the one in the Colne succumbed to a charge of small shot.

From the above list it will be seen that I claim for Essex a total of forty mammals, besides the three doubtful ones,—the common marten (*Mustela foina*), grey seal (*Halichærus gryphus*), and red deer (*Cervus elephas*). There are probably some other members of the order Cetacea which ought to be included in this Catalogue.

Those I have mentioned belong to the following orders:—

CHEIROPTERA	.	.	.	.	7 species.
INSECTIVORA	.	.	.	.	5 „
CARNIVORA	.	.	.	.	8 „
RODENTIA	.	.	.	.	12 „
RUMINANTIA	.	.	.	.	1 „
CETACEA	.	.	.	.	7 „
					—
					40 „
					—

I have had no opportunity for comparing a list of the Faunas of the adjoining counties, excepting that of Norfolk, by the Rev. Richard Lubbock, published in 1845, and he records only thirty-four mammals; but the authors of the last edition of Bell's 'British Quadrupeds' describe a total of seventy-three as occurring in the British Islands. Considering the cultivated and enclosed condition of many parts of Essex, I think the catalogue of forty mammals compares very well with the list for the whole of Britain, especially when we remember that several cetaceans and seals are in all probability only absent by reason of deficient observation, and may be eventually recorded as members of the Essex Fauna when more attention is paid to the scientific study of our Mammalia.

**XV. A PRELIMINARY LIST OF THE HYMENOMYCETAL FUNGI OF
EPPING FOREST; A CONTRIBUTION TO THE BOTANY OF THE
COUNTY.**

By **M. C. COOKE, M.A., LL.D., A.L.S., &c., and
JAMES L. ENGLISH.**

[Read November 26th and December 17th, 1881.]

[THIS list of the Fungi of the family Hymenomycetes, occurring within the Forest Districts, is intended only as a prodromus of the more extended and exhaustive catalogue to which we may look forward as the result of the persevering labours of our botanical members and others. It enumerates all the species of the family (888 in number) yet identified with certainty as growing within the prescribed district, which lies on both sides of the line separating Provinces I. and II. of Professor Boulger's sketch-map of the County (Plate VI.). The list has been compiled by Dr. Cooke ["C."] from his notes of personal visits to the Forest, and from materials furnished as the result of many years' observation by Mr. English, of Epping ["E."], with the addition of a few species noted by Mr. Worthington G. Smith. The indication of precise localities is purposely avoided, as being almost useless; fungi are very capricious and evanescent in their places of growth, slight local changes often resulting in the appearance of species in new stations, or in the destruction of old and well-known habitats. The word "Epping" appended to Mr. English's records must be taken with rather a wide interpretation: it includes the woods near the town of that name, with Monk Woods, Theydon Woods, &c.,—in short, the northern section of Epping Forest.

The list will doubtless be considerably extended as the Cryptogamic flora of Essex is more thoroughly investigated; but it is thought best to print it as it stands, to serve as an indication of the riches of the Forest, and as a guide to

visitors at our "Fungus Forays." Supplemental lists will be published from time to time as materials accumulate, and authenticated records of new gatherings will always be gladly received by the Editor for that purpose.

Most of the species mentioned are described in Dr. Cooke's 'Handbook of British Fungi' (1871) or in the volumes of 'Grevillea' (1872 *et seq.*), and coloured figures of many are given in the latter periodical and in Cooke's 'Illustrations of British Fungi' now in course of publication.—Ed.]

- AGARICUS (AMANITA) PHALLOIDES, Fr. Common (C.)
 „ MAPPA, Fr. Epping (E.)
 „ VERNUS, Fr. Highbeach (C.)
 „ MUSCARIUS, Fr. Monks Wood (C.)
 „ PANTHERINUS, Fr. Highbeach (C.)
 „ EXCELSUS, Fr. Monks Wood (C.)
 „ RUBESCENS, Fr. Common (C.)
 „ VAGINATUS, Fr. Common (C.)
 „ STRANGULATUS, Fr. (W. G. Smith.)
 AGARICUS (LEPIOTA) PROCEBUS, Fr. Loughton (C.)
 „ RHACODES, Fr. Epping (E.)
 „ EXCORIATUS, Schæff. Epping (E.)
 „ ACUTESQUAMOSUS, Wm. Epping (E.)
 „ CRISTATUS, Fr. Epping (E.)
 „ GRANULOSUS, Fr. Common (C.)
 AGARICUS (ARMILLARIA) MELLEUS, Fr. Common (C.)
 „ MUCIDUS, Fr. Highbeach (C.)
 AGARICUS (TRICHOLOMA) SEJUNCTUS, Sow. Highbeach (C.)
 „ GAMBOSUS, Fr. Epping (E.)
 „ NICTITANS, Fr. (W. G. Smith.)
 „ GRAMMOPODIUS, Bull. Epping (E.)
 „ FULVELLUS, Fr. (W. G. Smith.)
 „ ACERBUS, Fr. Epping (E.)
 „ USTALIS, Fr. Monks Wood (C.)
 „ COLUMBETTA, Fr. Epping (E.)
 „ CIVILIS, Fr. Epping (C.)
 „ VACCINUS, Fr. Epping (E.)
 „ FLAVOBRUNNEUS, Fr. Monks Wood (C.)

- AGARICUS (TRICHOLOMA) ALBOBRUNNEUS**, Fr. Epping (E.)
 „ **TERREUS**, Fr. Epping, &c. (C.)
 „ **RUTILANS**, Schæff. Epping (E.)
 „ **SAPONACEUS**, Fr. Monks Wood (C.)
 „ **CARNEUS**, Fr. Epping (E.)
 „ **RESPLENDENS**, Fr. Epping (E.)
 „ **IMERICATUS**, Fr. Epping (E.)
 „ **PERSONATUS**, Fr. Epping (E.)
 „ **NUDUS**, Fr. Loughton (C.)
 „ **SUBPULVERULENTUS**, Fr. Epping (E.)
AGARICUS (CLITOCYBE) INFUNDIBULIFORMIS, Fr. Common (C.)
 „ **CYATHIFORMIS**, Fr. Epping (E.)
 „ **FLACCIDUS**, Sow. Highbeach (C.)
 „ **NEBULARIS**, Fr. Epping (E.)
 „ **ERICETORUM**, Fr. Loughton (C.)
 „ **MAXIMUS**, Fr. Epping (E.)
 „ **FUMOSUS**, Fr. Epping (E.)
 „ **DEALBATUS**, Fr. Epping (E.)
 „ **BRUMALIS**, Fr. Highbeach (C.)
 „ **METACHROUS**, Fr. Epping (E.)
 „ **BELLUS**, Fr. Loughton (C.)
 „ **ODORUS**, Fr. Epping (E.)
 „ **LACCATUS**, Fr. Common (C.)
 „ **PHYLLOPHILUS**, Fr. Epping (E.)
 „ **ELIXUS**, Sow. Epping (C.)
AGARICUS (COLLYBIA) RADICATUS, Fr. Common (C.)
 „ **VELUTIPES**, Fr. Highbeach (C.)
 „ **FUSIPES**, Bull. Loughton (C.)
 „ **MACULATUS**, Fr. Highbeach (C.)
 „ **BUTYRACEUS**, Fr. Monks Wood (C.)
 „ **CIRRHATUS**, Schum. Loughton (C.)
 „ **TUBEROSUS**, Bull. Monks Wood (C.)
 „ **MUSCIGENUS**, Fr. Highbeach (C.)
 „ **DRYOPHILUS**, Bull. Loughton (C.)
AGARICUS (MYCENA) PURUS, P. Loughton (C.)
 „ **GALERICULATUS**, Scop. Common (C.)
 „ **POLYGRAMMUS**, Bull. Loughton (C.)
 „ **LACTEUS**, Pers. Epping (E.)

- AGARICUS (MYCENA) ELEGANS, Fr. Loughton (C.)
 „ ALCALINUS, Fr. Loughton (C.)
 „ GALOPUS, Fr. Epping (E.)
 „ EPIPTERYGIUS, Scop. Loughton (C.)
 AGARICUS (OMPHALIA) FIBULA, Fr. Loughton (C.)
 „ PYXIDATUS, Bull. Epping (E.)
 AGARICUS (PLEUROTUS) SPONGIOSUS, Fr. Epping (C.)
 „ DRYINUS, Fr. Epping (E.)
 „ OSTREATUS, Fr. Epping (E.)
 „ PETALOIDES, Bull. Epping (E.)
 „ CHIONEUS, Pers. Epping (E.)
 AGARICUS (ANNULARIA) CRETACEUS, Ph. Epping (E.)
 AGARICUS (PLUTEUS) CERVINUS, Fr. Loughton (C.)
 „ UMBROSUS, Fr. Epping (E.)
 AGARICUS (ENTOLOMA) PRUNULOIDES, Fr. Monks Wood (C.)
 „ RHODOPOLIUS, Fr. Epping (E.)
 „ SINUATUS, Fr. Loughton (C.)
 „ SERICEUS, Fr. Highbeach (C.)
 „ GRISEO-CYANEUS, Fr. Epping (E.)
 „ NIDOROSUS, Fr. Monks Wood (C.)
 AGARICUS (CLITOPILUS) PRUNULUS, Fr. Epping (C.)
 „ ORCELLA, Fr. Epping (E.)
 AGARICUS (NOLANEA) PASCUUS, Fr. Loughton (C.)
 „ PISCIODORUS, Fr. Epping (E.)
 AGARICUS (CLAUDOPUS) VARIABILIS, Fr. Loughton (C.)
 „ EUOSMUS, Fr. Epping (E.)
 AGARICUS (PHOLIOTA) SQUARROSUS, Fr. Epping (C.)
 „ RADICOSUS, Bull. Epping (E.)
 „ ADIPOSUS, Fr. Epping (E.)
 „ SPECTABILIS, Fr. Epping (E.)
 „ MUTABILIS, Schæff. Epping (E.)
 AGARICUS (INOCYBE) GEOPHYLLUS, Fr. Common (C.)
 „ RIMOSUS, Bull. Epping (E.)
 „ PYRIODORUS, Pers. Epping (E.)
 AGARICUS (HEBELOMA) FASTIBILIS, Fr. Epping (E.)
 AGARICUS (FLAMMULA) DECIPIENS, Sm. Epping (C.)
 „ SPUMOSUS, Fr. Epping (C.)
 „ GUMMOSUS, Fr. Epping (E.)

- AGARICUS (FLAMMULA) CARBONARIUS**, Fr. Epping (E.)
 „ **ALNICOLA**, Fr. Epping (C.)
 „ **HYBRIDUS**, Fr. Epping (C.)
AGARICUS (NAUCORIA) SEMIORBICULARIS, Bull. Loughton (C.)
 „ **MELINOIDES**, Bull. Highbeach (C.)
AGARICUS (GALERA) TENER, Schæff. Common (C.)
 „ **OVALIS**, Fr. Highbeach (C.)
 „ **HYPNORUM**, Batsch. Loughton (C.)
AGARICUS (TURARIA) FURFURACEUS, P. Epping (E.)
AGARICUS (PSALLIOTA) CAMPESTRIS, L. Epping (C.)
 „ **PRATENSIS**, Schæff. Epping (E.)
 „ **INUNCTUS**, Fr. Epping (C.)
AGARICUS (STROPHARIA) ÆRUGINOSUS, Curt. Loughton (C.)
 „ **WORTHINGTONII**, Fr. Highbeach, Epping (C.)
 „ **OBTURATUS**, Fr. Epping (E.)
 „ **SQUAMOSUS**, Fr. Loughton (C.)
 „ **SEMIGLOBATUS**, Batsch. Common (C.)
AGARICUS (HYPHOLOMA) SUBLATERITUS, Schæff. Common (C.)
 „ **FASCICULARIS**, Huds. Common (C.)
 „ **UDUS**, P. Loughton (C.)
 „ **STOREA**, Fr. Epping (C.)
 „ **LACRYMABUNDUS**, Fr. Loughton (C.)
 „ **APPENDICULATUS**, Fr. Loughton (C.)
AGARICUS (PSILOCYBE) ERICÆUS, P. Loughton (C.)
 „ **SEMILANCEATUS**, Fr. Common (C.)
 „ **SPADICEUS**, Fr. Common (C.)
 „ **FÆNISÆCII**, Fr. Common (C.)
AGARICUS (PSATHYRA) CONOPILEUS, Fr. Loughton (C.)
AGARICUS (PANÆOLUS) SEPARATUS, Fr. Monks Wood (C.)
 „ **FIMIPUTRIS**, Fr. Loughton (C.)
 „ **RETIRUGIS**, Fr. Loughton (C.)
 „ **CAMPANULATUS**, Fr. Loughton (C.)
 „ **SPHINCTRINUS**, Fr. Monks Wood (C.)
AGARICUS (PSATHYRELLA) DISSEMINATUS, Fr. Loughton (C.)
COPRINUS ATRAMENTARIUS, Fr. Loughton (C.)
 „ **COMATUS**, Fr. Epping (E.)
 „ **OVATUS**, Fr. Epping (E.)

- COPRINUS NIVEUS**, Fr. Common (C.)
 „ **MICACEUS**, Fr. Common (C.)
 „ **DELIQUESCENS**, Fr. Epping (E.)
 „ **PICACEUS**, Fr. Hainault Forest (C.)
 „ **ARATUS**, B. & Br. Monks Wood (C.)
 „ **PLICATILIS**, Fr. Epping (E.)
 „ **RADIATUS**, Fr. Loughton (C.)
CORTINARIUS (PHLEG.) LARGUS, Fr. Loughton (C.)
 „ **PURPURASCENS**, Fr. Highbeach (C.)
 „ **DECOLORATUS**, Fr. Epping (C.)
 „ **GLAUCOPUS**, Fr. Highbeach (C.)
CORTINARIUS (MYX) ELATIOR, Fr. Common (C.)
 „ **RIEDERI**, Fr. Loughton (C.)
 „ **COLLINITUS**, Fr. Epping (E.)
CORTINARIUS (INO) ALBOVIOLASCENS, Fr. Highbeach (C.)
 „ **VIOLACEUS**, Fr. Epping (E.)
 „ **BOLARIS**, Fr. Epping (E.)
CORTINARIUS (DERM.) OCHROLEUCUS, Fr. High Beach (C.)
 „ **TABULARIS**, Fr. Epping (E.)
 „ **ORELLANUS**, Fr. Epping (E.)
 „ **ANOMALUS**, Fr. Epping (E.)
 „ **DECUMBENS**, Fr. Epping (C.)
 „ **SANGUINEUS**, Fr. Epping (E.)
 „ **CINNABARINUS**, Fr. Monks Wood (C.)
 „ **CINNAMOMEUS**, Fr. Monks Wood (C.)
CORTINARIUS (TELAM.) HINNULEUS, Fr. Epping (E.)
CORTINARIUS (HYD.) DECIPIENS, Fr. Loughton (C.)
 „ **RIGENS**, Fr. Epping (E.)
PAXILLUS INVOLUTUS, Fr. Common (C.)
HYGROPHORUS EBURNEUS, Fr. Highbeach (C.)
 „ **COSSUS**, Fr. Monks Wood (C.)
 „ **LÆTUS**, Fr. (*Houghtoni*, B.) Loughton (C.)
 „ **PRATENSIS**, Fr. Epping (E.)
 „ **VIRGINEUS**, Fr. Epping (E.)
 „ **COLEMANNIANUS**, Blox. Epping (E.)
 „ **CERACEUS**, Fr. Epping (E.)
 „ **COCCINEUS**, Fr. Epping (E.)
 „ **CONICUS**, Fr. Epping (E.)

- HYGROPHORUS PSITTACINUS**, Fr. Epping (E.)
 ,, **CHRYSDON**, Fr. Monks Wood (C.)
 ,, **MINIATUS**, Fr. Monks Wood (C.)
GOMPHIDIUS GLUTINOSUS, Fr. Epping (E.)
LACTARIUS ELENNIUS, Fr. Monks Wood (C.)
 ,, **TORMINOSUS**, Fr. Epping (E.)
 ,, **TURPIS**, Fr. Epping (E.)
 ,, **CONTOVERSUS**, Fr. Epping (E.)
 ,, **TRIVIALIS**, Fr. Epping (E.)
 ,, **PYROGALUS**, Fr. Epping (E.)
 ,, **CHRYSORRHOEUS**, Fr. Epping (E.)
 ,, **DELICIOSUS**, Fr. Epping (E.)
 ,, **INSULSUS**, Fr. Epping (E.)
 ,, **GLYCIOSMUS**, Fr. Epping (E.)
 ,, **FULIGINOSUS**, Fr. Epping (E.)
 ,, **VOLEMUM**, Fr. Epping (E.)
 ,, **CAMPHORATUS**, Fr. Epping (E.)
 ,, **QUIETUS**, Fr. Monks Wood (C.)
 ,, **PIPERATUS**, Fr. Loughton (C.)
 ,, **VELLEREUS**, Fr. Loughton (C.)
 ,, **PALLIDUS**, Fr. Monks Wood (C.)
 ,, **RUFUS**, Fr. Loughton (C.)
 ,, **MITISSIMUS**, Fr. Loughton (C.)
 ,, **SUBDULCIS**, Fr. Loughton (C.)
 ,, **SERIFLUUS**, Fr. Loughton (C.)
RUSSULA NIGRICANS, Fr. Common (C.)
 ,, **ADUSTA**, Fr. Loughton (C.)
 ,, **FURCATA**, Fr. Loughton (C.)
 ,, **BOSACEA**, Fr. Epping (E.)
 ,, **VIRESCENS**, Fr. Epping (C.)
 ,, **FOETENS**, Fr. Epping (C.)
 ,, **OCHROLEUCA**, Fr. Monks Wood (C.)
 ,, **LEPIDA**, Fr. Epping (E.)
 ,, **DEPALLENS**, Fr. Monks Wood (C.)
 ,, **FELLEA**, Fr. Highbeach (C.)
 ,, **INTEGRA**, Fr. Monks Wood (C.)
 ,, **ALUTACEA**, Fr. Epping (E.)
 ,, **CYANOXANTHA**, Fr. Loughton (C.)

- RUSSULA HETEROPHYLLA**, Fr. Loughton (C.)
 „ **EMETICA**, Fr. Loughton (C.)
 „ **DECOLORANS**, Fr. Epping (E.)
 „ **FRAGILIS**, Fr. Common (C.)
 „ **CITRINA**, Gillet. Common (C.)
 „ **LUTEA**, Fr. Highbeach (C.)
 „ **CUTEFRACTA**, Cooke. Loughton (C.)
CANTHARELLUS CIBARIUS, Fr. Loughton (C.)
 „ **AURANTIACUS**, Fr. Loughton (C.)
 „ **TUBÆFORMIS**, Fr. Loughton (C.)
NYCTALIS PARASITICA, Fr. Loughton (C.)
 „ **ASTEROPHORA**, Fr. Epping (E.)
MARASMIUS PERONATUS, Fr. Loughton (C.)
 „ **URENS**, Fr. Epping (E.)
 „ **RAMEALIS**, Fr. Loughton (C.)
 „ **OREADES**, Fr. Epping (E.)
 „ **ROTULA**, Fr. Loughton (C.)
 „ **HUDSONI**, Fr. Wanstead (C.)
 „ **FUSCO-PURPUREUS**, Fr. Epping (E.)
 „ **ANDROSACEUS**, Fr. Loughton (C.)
 „ **EPIPHYLLUS**, Fr. Loughton (C.)
LENTINUS LEPIDEUS, Fr. Epping (E.)
 „ **COCHLEATUS**, Fr. Epping (E.)
PANUS STYPTICUS, Fr. Loughton (C.)
 „ **TORULOSUS**, Fr. Epping (E.)
LENZITES BETULINA, Fr. Common (C.)
BOLETUS ELEGANS, Schum. Loughton (C.)
 „ **FLAVUS**, Fr. Epping (E.)
 „ **CHRYSENTERON**, Fr. Loughton (C.)
 „ **SUBTOMENTOSUS**, Fr. Epping (C.)
 „ **BOVINUS**, Fr. Epping (E.)
 „ **PIPERATUS**, Fr. Epping, Hainault Forest (C.)
 „ **PACHYPUS**, Fr. Epping (C.)
 „ **RUBINUS**, Sm. Epping (E.)
 „ **EDULIS**, Fr. Highbeach (C.)
 „ **SCABER**, Fr. Highbeach (C.)
 „ **ÆSTIVALIS**, Fr. Epping (E.)
 „ **LURIDUS**, Fr. Highbeach (C.)

- BOLETUS SATANAS**, Fr. Epping (E.)
 „ **ERYTHROPUS**, Fr. Monks Wood (C.)
 „ **CALOPUS**, Fr. Epping (C.)
FISTULINA HEPATICA, Fr. Epping (C.)
POLYPORUS SCHWEINITZII, Fr. Epping (E.)
 „ **RUFESCENS**, Fr. Epping (E.)
 „ **PERENNIS**, L. Epping (E.)
 „ **SQUAMOSUS**, Huds. Epping (C.)
 „ **PICIPES**, Fr. Epping (E.)
 „ **VARIUS**, Fr. Epping (C.)
 „ **ELEGANS**, Fr. Epping (E.)
 „ **LUCIDUS**, Fr. Epping (E.)
 „ **INTYBACEUS**, Fr. Epping (E.)
 „ **GIGANTEUS**, Fr. Epping (E.)
 „ **SULPHUREUS**, Fr. Epping (E.)
 „ **IMBRICATUS**, Bull. Epping (E.)
 „ **ADUSTUS**, Fr. Loughton (C.)
 „ **CÆSIUS**, Fr. Hainault Forest (C.)
 „ **ADIPOSUS**, B. & Br. Epping (E.)
 „ **HISPIDUS**, Fr. Epping (E.)
 „ **CUTICULARIS**, Fr. Epping (E.)
 „ **DRYADEUS**, Fr. Epping (E.)
 „ **BETULINUS**, Bull. Epping (E.)
 „ **FOMENTARIUS**, Fr. Epping (E.)
 „ **IGNIARIUS**, Fr. Epping (E.)
 „ **ANNOSUS**, Fr. Loughton (C.)
 „ **VERSICOLOR**, L. Common (C.)
 „ **VAPORARIUS**, Fr. Common (C.)
TRAMETES MOLLIS, Fr. Epping (C.)
 „ **GIBBOSA**, Fr. Epping (E.)
DÆDALEA QUERCINA, Fr. Epping (C.)
 „ **CONFRAGOSA**, Fr. Highbeach (C.)
 „ **UNICOLOR**, Fr. Epping (C.)
MERULIUS CORIUM, Fr. Epping (C.)
 „ **TREMELLOSUS**, Fr. Epping (E.)
HYDNUM REPANDUM, Fr. Epping (C.)
 „ **ERINACEUM**, Fr. Epping (E.)
 „ **ZONATUM**, Fr. Epping (E.)

- HYDNUM FERRUGINOSUM**, Fr. Epping (E.)
 „ **CIRRHATUM**, Fr. Epping (C.)
SISTOTREMA CONFLUENS, Fr. Epping (E.)
RADULUM FAGINEUM, Fr. Epping (C.)
 „ **QUERCINUM**, Fr. Epping (C.)
CRATERELLUS CORNUCOPIODES, Fr. Loughton (C.)
 „ **CRISPUS**. Highbeach (C.)
THELEPHORA CARYOPHYLLÆA, Fr. Loughton (C.)
 „ **CLAVULARIS**, Fr. Epping (E.)
 „ **ANTHOCEPHALA**, Fr. Hainault Forest (C.)
 „ **LACINIATA**, P. Loughton (C.)
 „ **MULTIZONATA**, Berk. Epping (C.)
 „ **CRISTATA**, Fr. Epping (E.)
 „ **CRUSTACEA**, Schum. Epping (C.)
STEREUM HIRSUTUM, Fr. Common (C.)
 „ **SPADICEUM**, Fr. Epping (E.)
 „ **PURPUREUM**, Fr. Highbeach (C.)
 „ **RUGOSUM**, Fr. Epping (E.)
 „ **SANGUINOLENTUM**, Fr. Loughton (C.)
HYMENOCHETE RUBIGINOSA, Lev. Epping (E.)
 „ **TABACINA**, Lev. Epping (E.)
AURICULARIA MESENERICA, Fr. Epping (E.)
PENIOPHORA QUERCINA, Fr. Loughton (E.)
CORTICIUM SERUM, Fr. Epping (C.)
 „ **LEVE**, Fr. Common (C.)
 „ **PUTEANUM**, Fr. Epping (C.)
 „ **SEBACEUM**, Fr. Epping (E.)
 „ **CELLARE**, P. Epping (C.)
CLAVARIA FLAVA, Schæff. Monks Wood (C.)
 „ **FASTIGIATA**, Fr. Epping (E.)
 „ **CINEREA**, Fr. Epping (E.)
 „ **CRISTATA**, Fr. Epping (E.)
 „ **AUREA**, Schæff. Epping (E.)
 „ **INÆQUALIS**, Fr. Epping (E.)
 „ **VERMICULATA**, Fr. Epping (E.)
 „ **CORALLOIDES**, L. Monks Wood (C.)
 „ **RUGOSA**, Fr. Wanstead (C.)
 „ **FUSIFORMIS**, Sow. Epping (C.)

- CLAVARIA PISTILLARIS, L. Monks Wood (C.)
CALOCERA VISCOSA, Fr. Epping (E.)
,, CORNEA, Fr. Epping (E.)
TYPHULA PHACORRHIZA, Fr. Walthamstow (C.)
TREMELLA FOLIACEA, Fr. Epping (C.)
,, MESENTERICA, Fr. Epping (E.)
EXIDIA GLANDULOSA, Fr. Loughton (C.)

The above list includes the species enumerated by Sowerby as having been found in this neighbourhood. In many genera the enumeration is known to be very imperfect, but this may be accounted for by the fact that until recently no definite record was kept, and only well ascertained species have been inserted under the impression that accuracy is preferable, even though it is secured by brevity. A first catalogue is usually an imperfect one, since it is limited to the observation of one or two individuals; but, with such a basis, it will not be difficult to extend it year by year, and to ultimately secure a moderately complete catalogue of the larger Fungi of the Forest district. To this end it is hoped that any well-authenticated occurrence of additional species will be communicated to the Secretary.—M. C. C.

XVI. THE PRESIDENTIAL ADDRESS; DELIVERED BY RAPHAEL
MELDOLA, F.R.A.S., F.C.S., AT THE ANNUAL MEETING,
JANUARY 28TH, 1882.

LADIES AND GENTLEMEN,

THE grateful task of congratulating you upon the completion of another annual cycle once more devolves upon me. Whilst fully sensible of the honour which you have conferred upon me by electing me for the third year to the Presidential Chair, I cannot but rejoice to think that our Society has now assumed such proportions that I may confidently look forward to seeing, at no very distant period, my present position filled by some gentleman having more direct claim to your consideration both as a local resident and a working naturalist. The duty of acting for another year the part of a nurse towards this Club, whose birth and growth I have watched with such interest, will, however, give me even more gratification than heretofore, since our ranks are filling with that class of members whose support we most value, and our publications show that we have commenced work in earnest.

During the past year our Society has had several resignations, and two deaths; but, notwithstanding this, we now number some 814 members as compared with 224 in our last year's list. The deaths we have to deplore are those of Mr. Walter P. Weston and Sir Antonio Brady.

Mr. Weston was well known as a student of our native Lepidoptera and Coleoptera, the Tortrices being his special objects of study. He also added considerably by his labours to our knowledge of the insects inhabiting oak-galls, whilst his activity as a general entomologist is borne witness to by his numerous contributions to the pages of the 'Entomologist.' Our late member died of consumption at a comparatively early age, and although I had not the pleasure of knowing

him personally, his friends were unanimous in testifying to his amiable disposition; and we cannot but express our sorrow at having lost a promising member who, had he been spared, would doubtless have taken an active part in the work of the Club.

At the meeting held on December 17th it was my painful duty to have to announce the death of Sir Antonio Brady; and as it is proposed to publish a special memoir of our deceased member, whose memory is still green among us, I will not at present give any account of his scientific work, but will simply put upon record the deep regret which the removal of this genial elephant-hunter of the Roding Valley has caused to all those who numbered him among their friends, and whose death will be felt most severely by our Club, in which he took such active interest, as well as by the scientific world in general.

The Essex Field Club is now so well launched on its career that I do not propose to dwell at any length upon our past or future work. My appeal to our own members to support us by their scientific contributions has, I am happy to see, borne fruit. During the year we have published three Parts of 'Transactions,' with the 'Journal of Proceedings,' and to these we may, I think, justly point with some pride, as evidence of our activity and as a guarantee of future exertion. Looking back to the line of work as laid down in my Inaugural Address of February 28th, 1880, I cannot but feel gratified to think in how short a period we have commenced to realise the position therein traced out. We have received this year several most valuable contributions to the lists of the County Fauna and Flora, and in the next part of our 'Transactions' we shall have the pleasure of seeing Mr. Henry Laver's lists of the Mammalia and Mollusca, Mr. Fitch's excellent paper upon the Essex Galls, and Dr. M. C. Cooke's list of the Hymenomycetal Fungi of the Loughton District. The papers published during the year are, if I may say so, typical of the class of subjects which our Society claimed at the outset as proper to the studies of a Field Club. Thus in Natural History we have Mr. White's suggestive

query as to the ancestry of *Vanessa Urtica*, reprinted *in extenso* in the 'Entomologist' for August, 1881; Mr. English's contribution to the history of "sugaring" for moths; and Mr. Saville Kent's admirable sketch of the Infusoria. In the department of Botany our energetic member Prof. Boulger has dealt with the larger problems of the evolution of fruits, and the origin and distribution of the British flora. In Geology we have been the means of giving publicity to Mr. Dalton's paper on the Blackwater Valley—a paper which is to be valued not only on account of its intrinsic interest, but because it has given us an opportunity of justifying an appeal to those officers of H. M. Geological Survey who have worked in our county, to enrich our 'Transactions' with some of their observations.

Our labours in the field of pre-historic Archæology demand more than a passing notice. Interesting "finds" of flint and bronze weapons have been exhibited and described by Mr. Henry Corder. The excavation of the ancient earthwork known as Ambresbury Banks has been so far successful that we are now able to state conclusively that this camp is of British construction. But although we have thus far dispelled the mystery enshrouding one of these Forest Camps, it must not be supposed that our investigations, commenced under such fortunate circumstances, are by any means completed. At least one other section through the Ambresbury earthwork will be desirable in order to obtain, if possible, more definite evidence as to the precise period of its erection, as stated in the report published in the last part of our 'Transactions.' We have further to congratulate ourselves that the exploration of the Loughton camp, which we hope to undertake in the course of the ensuing summer, has been considered a task worthy of recognition by the British Association, that body, at the jubilee meeting held in York, having appointed for this purpose a committee composed of members of our Club. I have no doubt but that the necessary funds will be forthcoming when an appeal is made to our members at large.

My review of this, our first extensive undertaking in the

way of archæological research, would be most seriously incomplete did I fail once more to remind you how much we owe to the skill and generosity of the eminent President of the Anthropological Institute, General Pitt-Rivers, who has not only directed our efforts and drawn up the account which is now in the hands of all our members, but has presented us with the coloured plate which graces Part 5 of our 'Transactions,' and adds so much to the value of the report.

There is no occasion for me to take up much more of your time this evening with other business matters; these have been stated fully in the Council Report, and I have to make a large demand upon your patience when I enter later into the scientific portion of my Address. I may just remark that our Museum has received valuable additions from Mr. William White, Mr. James English, Mr. Henry Cole, and Mr. Harcourt. All our meetings, both field and ordinary, have been remarkably well attended, and we have had the pleasure of joining with the Geologists' Association, with the subscribers to the Chelmsford Museum, and with the Hertfordshire Field Club, in excursions to Grays, Chelmsford, and Epping Forest respectively.

The public lectures which we commenced last session in connection with the Club have been discontinued on account of the great amount of extra work which they threw upon our excellent Hon. Secretary, and because of the insufficient support which we received in the neighbourhood.

Although my time is limited I cannot lightly pass over my obligations to my friend Mr. William Cole, for the zealous and able manner in which he has performed those most arduous duties which he has so generously taken upon himself, and in the execution of which he has so considerably lightened the gratifying and honourable tasks which I have had the pleasure of fulfilling on your behalf during the past year. Nor can we fail to acknowledge the valuable services of our Librarian, Mr. Alfred Lockyer, whose energetic efforts are so apparent in the excellent state of our small but growing library. Our Treasurer, Mr. Henry J. Barnes, had unfortunately to leave us before the expiration of the year,

but his brother, Mr. Richard L. Barnes, has most kindly and efficiently been carrying on his duties for him during his absence.

Summing up the results achieved during the second year of our existence, we have every reason to be satisfied with our position. We may at first have appeared to be aiming rather high in aspiring to the rank of the County Club, but our present list of members shows that we are justified in laying claim to this title. We have mustered our scientific forces farther afield, and we hope during the approaching season to gather fresh strength from the farthestmost limits of our County.

As the prosperity of our Club has happily rendered unnecessary anything more than a general sketch of our labours, I have thought it best to establish a precedent for maintaining the activity of the Presidential Chair by offering for your consideration a memoir upon a special biological subject, and to this I will at once proceed without further delay.

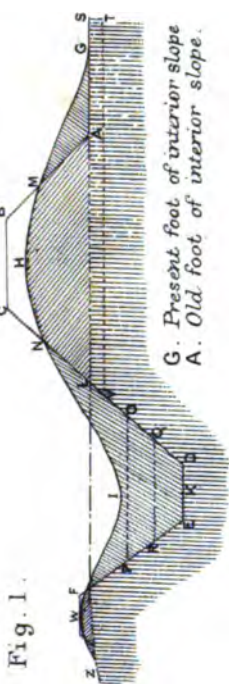
[The President then read the first part of an exhaustive essay on "The Phenomena of Cyclical Propagation in the Animal Kingdom." This memoir will be printed as a separate paper in the next volume of the 'Transactions.'—Ed.]



IMAGINARY SECTION THROUGH RAMPART OF A CAMP. Drawn by General Pitt-Rivers.

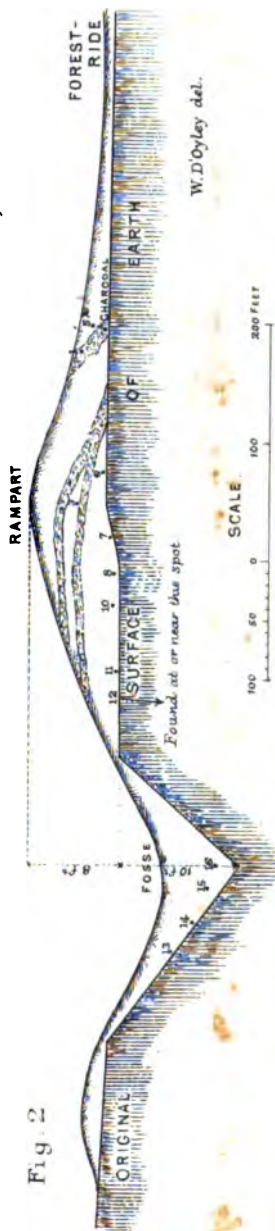
- A.B.C.L. Original Shape of Rampart.
- D.K.E.F. Original Shape of Ditch.
- 3.L.Z. Old Surface line.
- 1.G.M. Silting of interior slope.
- A.M. Old interior slope.
- V.G. Present interior slope.
- 4.D.E.W. Silting of Ditch.
- N.D. Escarp.
- E.F. Counterscarp.

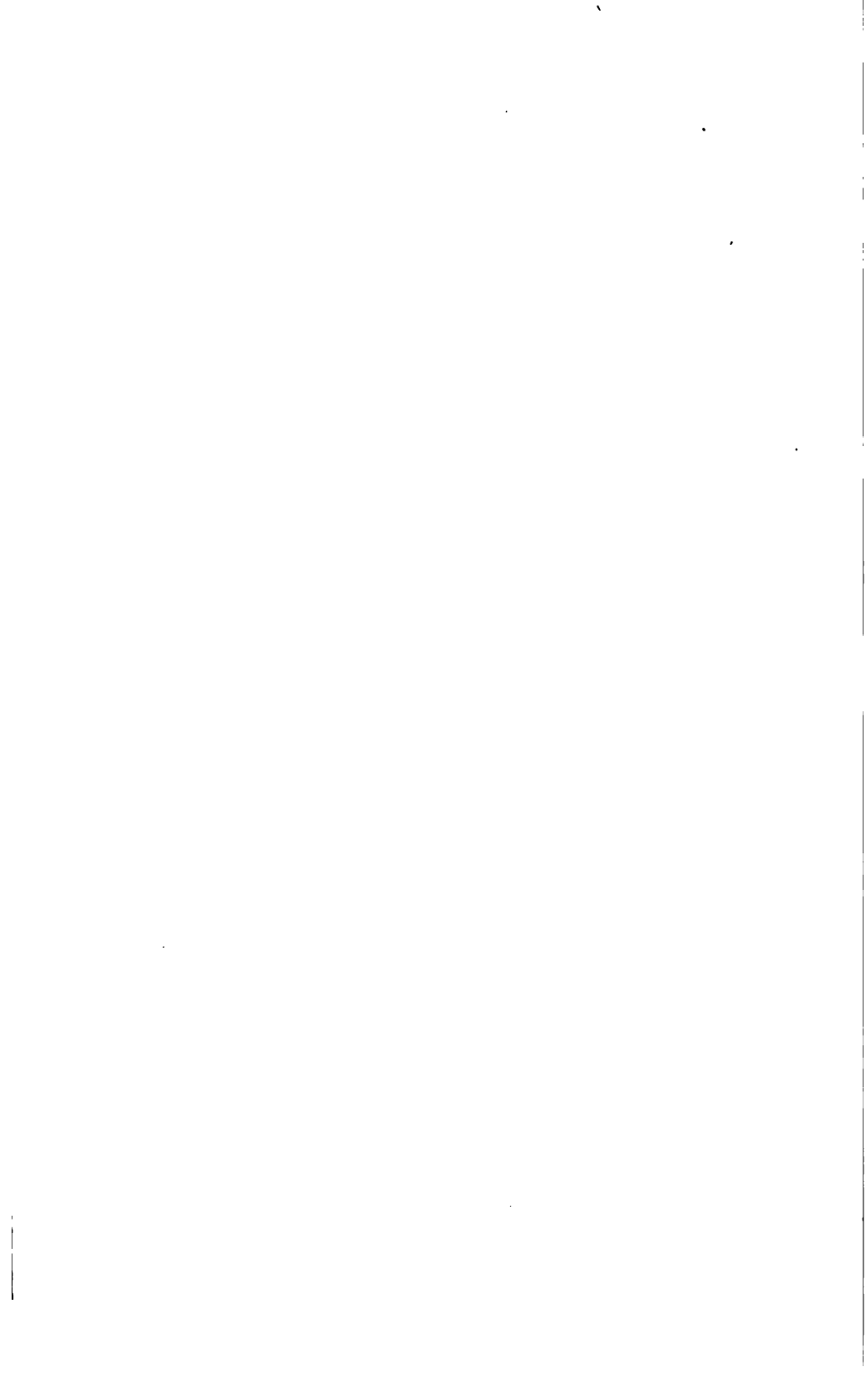
- A.M.N.L. Body of Rampart.
- D.E... Bottom of Ditch.
- I... Present centre of Bottom.
- K... Old centre of Bottom.
- N.O.P.F. First spit taken out of Ditch.
- O.P.Q.R. Second spit taken out of Ditch.
- E.D.Q.R. Third spit taken out of Ditch.
- T.V... Bottom of Section through Ramp.

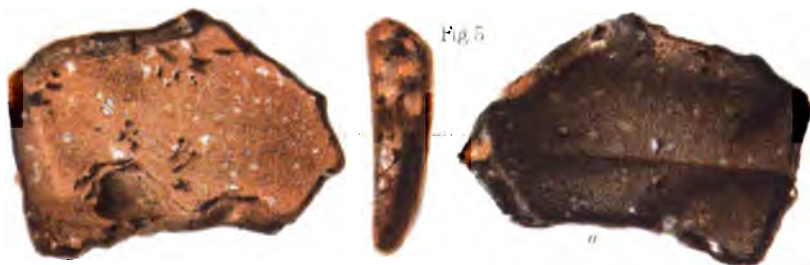


- Silting
- Body of Rampart.
- Undisturbed Ground.

SECTION THROUGH RAMPART. (Northern Face. — Position of Objects found projected on one vertical plane.)







APPENDIX.



REPORT OF THE COUNCIL AND BALANCE SHEET FOR 1881;

CATALOGUE OF THE LIBRARY;

LIST OF MEMBERS, &c.

Corrected to March 25th, 1882.

ESSEX FIELD CLUB,
BUCKHURST HILL.

Dr. TREASURER'S STATEMENT OF ACCOUNT FOR THE YEAR ENDING DECEMBER 31ST, 1881. Cr.

	£	s.	d.	£	s.	d.
To Balance from 1880	54	16	2			
Less Life Compositions carried to separate account	36	15	0			
Subscriptions, 1880	2	17	0	18	1	2
" " 1881	121	11	6			
" " 1882	7	5	6			
Receipts at Lecture	131	14	0			
" Donations to Publication expenses	14	2	0			
" Sale of Publications	3	10	0			
" Receipts at Field Meetings	4	2	10			
	43	0	0			
				13	12	1
				48	8	5
				15	1	4
				72	16	5
				29	18	11
				2314	10	0

LIFE COMPOSITION ACCOUNT.

To Seven Compositions received in 1880	36	15	0	By Furniture and Fittings for Library and Museum....	38	4	6
" " 1881	15	15	0	Balance	19	5	6
				252	10	0	
				252	10	0	

FOREST CAMPS EXPLORATION FUND.

To Subscriptions received to date	45	12	0	By Expenses of Excavating	23	10	0
				" Sundry Expenses	17	10	10
				Balance	5	11	2
				245	12	0	

SUMMARY.

Balance in hand	29	18	11	Estimated Liabilities	38	0	0
Unpaid Subscriptions	21	16	6				
Balance of Life Compositions	19	5	6				
" Camp Fund	5	11	2				

January 27th, 1882.

R. L. BARNES,
Treasurer pro tem.

Examined and found correct,
R. LETCHFORD, }
N. F. ROBERTS. } Auditors.

REPORT OF THE COUNCIL FOR THE YEAR 1881.

[*Read at the Second Annual General Meeting, held at
Buckhurst Hill, January 28th, 1882.*]

THE Council has great pleasure in announcing the continued and increasing prosperity of the Essex Field Club since its formation in January, 1880. Enthusiastic views as the future of the Society were often met by gloomy forebodings as to the difficulties of steering such an association through the the second year of its existence, when the attraction of novelty had perhaps worn off before any real and lasting work had been accomplished, and before the Society had earned its title to respect and to steady and hearty support. It may safely be asserted that the Club has left such dangers well in its wake, or rather that it has never encountered them; and the rapid increase in its numbers and the intelligent interest taken in its proceedings have been constant and very gratifying experiences during the year 1881.

Since the last Report (which gave a summary of the work of the Society up to 31st December, 1880), 102 ordinary members and 5 honorary members have been elected, of whom 3 have compounded for their annual subscriptions; 14 members have resigned; 1 has been removed for non-payment of subscription, and the Council records with great regret the loss of two original members by death—Sir Antonio Brady and Mr. Walter Weston. Short obituary notices of these gentlemen will be given by the President in his annual address.

The census of the Club at the end of the years 1880 and 1881 was therefore as follows:—

	1880.	1881.
Honorary members	4	9
Life members	7	10
Ordinary members.....	213	295
	<hr/> 224	<hr/> 314

Showing a net increase of 90 members during the past year. This result may be taken as an index of the rapid rise of the Club in public esteem, and there seems to be no reason for believing that the supply of candidates for admission into the Society is exhausted. Satisfactory as the roll now is, the annual income is not enough to publish well-illustrated 'Transactions' to the full extent desired—an increase of (say) 100 subscribers to the funds of the Club would enable the Council to print half

or two-thirds more matter, and so give each individual member a higher return for his or her subscription than at present, while the Society would more thoroughly fulfil one of its most useful and permanently valuable functions. An inspection of the list of members will show that the Club is surely, although perhaps somewhat slowly, making its way among the inhabitants of parts of Essex remote from the headquarters. All well-wishers of the Society will desire to see this class of members largely increased. The Club should have representatives in every parish in the county, and remembering the very small subscription asked from members living outside the radius of 15 miles from headquarters, it is manifest that such members will eventually receive even more than a fair equivalent in the shape of publications for their expenditure.

A deputation, consisting of the President and Treasurer, and Mr. John Spiller, waited upon Mr. Parkes, the Chairman of the Great Eastern Railway Company in July last, when the latter very kindly granted the important concession as to fares payable by members attending the meetings, which has been taken advantage of on many occasions, and which cannot fail to be of great utility both to the Society and to the members. The best thanks of the Society are due to the Directors for their kindness, and to Mr. J. Robertson, Superintendent of the line, for his many courtesies in connection therewith.

Three parts of the 'Transactions' have been published during the year, comprising (with the reprinted rules and list of members) 188 pages of letterpress, and six plates, one being coloured. The Council early saw the necessity of the 'Transactions' being sent out by an experienced printer, and the two parts produced by Messrs. West, Newman, & Co. leave little to be desired as regards appearance and general accuracy. The desire of the Editor has been to give full and faithful records of the popular as well as of the scientific work of the Society,—how far this desire has been fulfilled it is for our critics to decide. As intimated in the account of the Grays Meeting, the Society is indebted to our President and to our members Messrs. J. Spiller and G. C. Harcourt for the autotype plate accompanying that report, and the special thanks of the Council and members are due to our honorary member, Major-General Pitt-Rivers, for his generous donation of £12 to defray cost of the chromolithographed plate of the objects found in the rampart of Ambresbury Banks.

The attendances at the meetings have been good, in spite of unfavourable weather on several occasions. Twelve ordinary meetings have been held during the year, at which 420 members have been present, giving an average of 35, with 102 visitors. Six field meetings were organised, 224 members having attended, or an average of 37, about 130 visitors having also been present. Three field meetings were held in conjunction with other Societies—the Geologists' Association, the Hertfordshire Natural History Society, and with the subscribers to the Essex and Chelmsford

Museum. The best thanks of the Club are due to the following gentlemen, who, in the kindest way, gave their valuable services as "conductors" at these meetings:—G. H. Birch, Esq., F. Chancellor, Esq., Professor Morris, Henry Walker, Esq., T. Fisher Unwin, Esq., W. Saville Kent, Esq., Professor Boulger, Dr. Cooke, Worthington G. Smith, Esq., Dr. Wharton, Mr. James English, Dr. Braithwaite, and E. M. Holmes, Esq. On the occasion of the visit to Chigwell, on June 25th, the members were most hospitably entertained at Oakhurst, by the Rev. W. Linton Wilson and Mrs. Wilson. The Rt. Rev. the Lord Bishop of St. Alban's kindly gave the Club permission to wander through the grounds and woods of Danbury Palace, and we have to thank the Rev. James Francis for permission to meet in his school room at Waltham, Rev. R. H. Brennan for a similar courtesy at Grays, and T. W. Wakefield, Esq., T. M. Gepp, Esq., Rev. T. P. Bridges, Edmund Durrant, Esq., Dr. Priest, Hy. Corder, Esq., and many other gentlemen, for aid afforded in organising these excursions. The Council also desires to thank the editors of the following newspapers, who have published from time to time reports of the meetings, and in other ways contributed to the success of the Club by making it widely known throughout the county:—The 'Essex Times,' 'Chelmsford Chronicle,' 'Essex Weekly News,' 'Essex Herald,' 'Waltham Abbey Telegraph,' and 'Woodford Times.'

After the careful report of General Pitt-Rivers, and the details given in the 'Proceedings,' but little remains to be said respecting the excavation at Ambresbury Banks. The Council cannot but congratulate the members on the good results which were obtained from the first scientific investigation undertaken by the Club. The success of such researches, of course, mainly depends upon the skill and care with which they are planned and conducted. The Society was particularly fortunate in enlisting the co-operation of an eminent and experienced Archæologist in the work. General Pitt-Rivers took a lively interest in the exploration throughout, and the Council cannot too strongly emphasise its deep sense of the value of his ready aid and sympathy. To Mr. D'Oyley also hearty acknowledgments are due. He took the greatest possible care in the matter, and was always ready to render all the help in his power. Mr. D'Oyley has kindly offered to act on future occasions as the Honorary Surveyor to the Club. The thanks of the Society should also be rendered to those gentlemen who, at considerable expenditure of time, attended as watchers at the excavations, and so rendered possible an accurate account of the objects found. The Council proposes to commence work upon the Loughton Camp as early as practicable in the spring, and also, if possible, to make further researches at Ambresbury in order to clear up some doubtful points. Of course, considerable funds will be required, and the Council confidently asks for liberal contributions towards a work, the successful accomplishment of which cannot fail to be of great advantage to the Club, as well of very considerable interest not only to members, but to all who take a pleasure in the discovery of reliable information

respecting the early history of the county and the wider questions involved in the facts which are gradually being revealed by means of such methods of inquiry concerning the non-historic periods in the life of the human race.

At the York meeting of the British Association the following members of the Club were honoured by being appointed a Committee to report upon this Loughton earthwork:—General Pitt-Rivers, Mr. R. Meldola, and Mr. W. Cole (Secretary). The Council can only hope that the second work may be at least as successful as the first, and that the Committee may be enabled to present a satisfactory report at the Southampton Congress of the British Association.

The Library has been growing steadily during the year, and it speaks well for the generosity of the members that almost all the books upon the shelves have been gratuitously presented, the only exceptions being a few volumes of 'Transactions,' &c., which have been acquired by exchange or purchase. The numerous scientific periodicals also which month by month have been laid upon the Library table, we owe to the kindness of several members, four of these journals only being received in return for the 'Transactions' of the Club. The Council recommends to the members generally this convenient method of benefitting the Society. There seems to be no reason why the Reading Room should not, in this way, be constantly supplied with the best periodical literature of science without any charge upon the general funds. The Librarian will be most happy to give information and advice to any one who may wish to act upon the suggestion in the future.

That the Club is beginning to take an honourable position among the older scientific Societies throughout the country is evidenced by a reference to the list of those with which it exchanges publications. The Council takes this opportunity of acknowledging the readiness with which the request to become thus associated has been responded to. The object in view has been to open relations with the leading Society in each county, and it is proposed to judiciously extend the "Exchange List" to counties which are still unrepresented, as opportunities may arise. In thickly populated districts it has been found desirable to include two or more Societies in the scheme, the subjects of study being more specialised than is the case in agricultural counties. The policy of presenting the 'Transactions' to the London Chartered Societies and a few of the chief scientific journals will be continued, but in no case will the number of copies presented or exchanged be allowed to exceed 100. A list of Societies, &c., to which publications are presented is appended to this report.

The number of books borrowed during the year has been very small, but it is hoped that as the Library increases in value and extent, the members will recognise the advantage of using it more frequently. A catalogue is in preparation, and when issued it will no doubt stimulate the circulation of the volumes, which at present number 150.

The heartiest thanks of the Club are due to those who have kindly presented books, pamphlets, periodicals, &c., and whose names will be found from time to time in the 'Journal of Proceedings.' Some of the volumes are of considerable and increasing value, and it is only necessary to add that the greatest possible care will be taken of all works entrusted to the keeping of the Librarian, who hopes to have a busy year in receiving additions to the Library, and circulating them among the members.

The Museum has also made some progress, although the additions to it have not been so numerous as to the Library. Early in the year the Council voted a sum of £36 15s. towards fitting up the rooms. About £33 of this amount has been so expended, but before much can be done in the very desirable work of collecting a series of the natural productions of Essex, a very considerable sum must be expended in the purchase of cabinets and cases. Attention has been more than once drawn to this matter at the meetings of the Society, and we have the benefit of a paper by Mr. Harting, which very clearly points out the line we should take and the methods to be employed in establishing a local museum. The Council must impress upon the members the desirability of aiding in every way in their power the growth of the collections. In this work almost every one can help, with but a small expenditure of money, and it may be pointed out to beginners and novices that no surer method is possible of acquiring a definite and useful knowledge of natural history than by judiciously collecting specimens under the guidance of some more advanced student in the same department. It is intended to issue some detailed instructions as soon as possible. Pressure of other matters connected with the Society has delayed the appearance of these hints, but it is hoped that they will be issued by the summer, and that an immediate result will be apparent in the extent of the Museum treasures.

The finances of the Society are not quite so satisfactory as could be wished, owing mainly to the number of subscriptions still unpaid. In the great majority of cases, no doubt, this neglect of the first duty members owe to the Society is the result of thoughtlessness, but the Council cannot too strongly appeal to the backward members to remedy this state of things. The repeated sending out of letters of application entails considerable expense, which is so much money wasted, and a more serious consequence is that non-compliance with the rule that *all subscriptions are payable in advance on January 1st in each year* throws upon the officers of the Society an amount of irksome and very unpleasant work, which it is not right that they as volunteers should be called upon to perform. Ill-health, necessitating an absence from England during the winter months, obliged Mr. H. J. Barnes to resign his office as Treasurer in the autumn. To Mr. Barnes, as its first Treasurer, the Society owes its best thanks, and the Council is sure that the members generally will echo the wish that he may return in the spring completely restored to health. Mr. R. L. Barnes very kindly undertook to act as Treasurer

until the general meeting, and the Council begs gratefully to acknowledge his valuable services.

The President attended the Conference of Scientific Societies held at York during the meeting of the British Association, as one of the delegates of the Essex Field Club. Little was done beyond appointing a Committee to take steps to have the Conference of Delegates recognised by the Council of the British Association, and resolving that a circular should be sent to the various local Societies, pointing out the work undertaken by the Committees of the Association, and the valuable aid which might be given by these Societies in that and other scientific work.

The thanks of the Society are again due to Miss Jane Cole and Mr. H. A. Cole for the use of rooms for meetings, and also for the sole use of the two rooms used as a library and museum.

LIST OF SOCIETIES, ETC., TO WHICH THE
'TRANSACTIONS' ARE PRESENTED.

Aylesbury. Buckinghamshire Architectural and Archæological Society.
 Belfast Natural History and Philosophical Society.
 ——— Naturalists' Field Club.
 Berwickshire Naturalists' Club.
 Birmingham Natural History and Microscopical Society.
 Bristol Naturalists' Society.
 Bury St. Edmunds. Suffolk Institute of Archæology and Natural History.
 Cambridge Philosophical Society.
 ——— University Library.
 Canterbury. East Kent Natural History Society.
 Cardiff Naturalists' Society.
 Chester Society of Natural Science.
 Chichester and West Sussex Natural History and Microscopical Society.
 Colchester. Essex Archæological Society.
 ——— Natural History Society.
 Devizes. Wiltshire Archæological and Natural History Society.
 Dublin. Royal Geological Society of Ireland.
 ——— Trinity College Library.
 ——— University Biological Association.
 Dulwich College Science Society.
 Dumfries-shire and Galloway Scientific, Natural History and Antiquarian Society.
 Eastbourne Natural History Society.

- Edinburgh. Advocates' Library.
 ——— Botanical Society.
 ——— Geological Society.
 Glasgow, Geological Society of.
 ———, Natural History Society of.
 ———, Philosophical Society of.
 Hackney Microscopical and Natural History Society.
 Hereford. Woolhope Naturalists' Field Club.
 Huddersfield. Editors of 'Naturalist.'
 Leeds. Editor of 'Journal of Conchology.'
 ———. Yorkshire Naturalists' Union.
 Leicester Literary and Philosophical Society.
 Lewisham. West Kent Natural History, Microscopical, and Photographic Society.
 Liverpool Geological Society.
 ——— Literary and Philosophical Society.
 ——— Naturalists' Field Club.
 London and Middlesex Archæological Society.
 London. Anthropological Institute of Great Britain and Ireland.
 ———. British Museum.
 ———. Entomological Society,
 ———. Geological Society.
 ———. Geologists' Association.
 ———. Guildhall Library.
 ———. Linnean Society.
 ———. Quekett Microscopical Club.
 ———. Royal Microscopical Society.
 ———. Royal Society.
 ———. Scientific Club.
 ———, South, Entomological Society.
 ———, West, Scientific Association.
 ———. Zoological Society.
 ———. Editor of 'Annals and Magazine of Natural History.'
 ———. " 'Antiquarian Magazine.'
 ———. " 'Antiquary.'
 ———. " 'Field.'
 ———. " 'Gardeners' Chronicle.'
 ———. " 'Gardeners' Magazine.'
 ———. " 'Geological Magazine.'
 ———. " 'Grevillea.'
 ———. " 'Journal of Botany.'
 ———. " 'Land and Water.'
 ———. " 'Nature.'
 ———. " 'Popular Science Review.'
 ———. " 'Science Gossip.'
 ———. " 'Scientific Roll.'
 ———. " 'Zoologist.'

Manchester Field Naturalists' and Archæologists' Society.
——— Geological Society.
——— Literary and Philosophical Society,
Newcastle-on-Tyne. Tyneside Naturalists' Field Club.
Newcastle, Staff. North Staffordshire Naturalists' Field Club.
New Cross Microscopical and Natural History Society.
Norfolk and Norwich Naturalists' Society.
Northampton Natural History Society.
Norwich Geological Society.
Nottingham Literary and Philosophical Society.
Ottawa Field Naturalists' Club.
Oxford. Bodleian Library.
Perthshire Society of Natural Science.
Plymouth Institution and Devon and Cornwall Natural History Society.
Salem, Mass. Essex Institute.
Sherborne. Dorset Natural History and Antiquarian Field Club.
Stroud. Cotteswold Naturalists' Field Club.
Taunton. Somersetshire Archæological and Natural History Society.
Truro. Royal Institution of Cornwall.
Walthamstow Microscopical and Natural History Society.
Watford. Hertfordshire Natural History Society and Field Club.

CATALOGUE OF THE LIBRARY.

LIBRARY REGULATIONS.

1.—Books may be borrowed by Members only, on application to the Librarian, at such times as the Rooms occupied by the Society are open to Members.

2.—The title of every book borrowed shall be entered in the Library Register, with the signature of the borrower.

3.—No Member may borrow more than one volume at a time, without the permission of the Council, and certain books (marked thus * in the Catalogue) may only be consulted at Head-quarters.

4.—No book may be retained longer than one month, but a Member may borrow the same volume for a further period, if no other application for it be made.

5.—All books shall be returned at the last Ordinary Meeting of each Session, and the issue shall not be resumed until the first Ordinary Meeting of the following Session.

6.—No map, plate, drawing, manuscript, or unbound publication, may be borrowed without the permission of the Council, but current numbers of periodicals, transactions, &c., will be laid upon the Library table, and back numbers of the same may be referred to on the premises, if necessary.

7.—Any Member failing to return a book on the application of the Librarian, or returning a book damaged or defaced, shall be liable for its value; and if it form part of a work, for the value of the whole work rendered imperfect.

*Books marked thus * do not circulate.*

ADAMS, H. G. Beautiful Butterflies. 8vo. London. [N. D.]

AMERICAN ENTOMOLOGIST. 2nd series. 8vo. New York, 1880.

ANON. [Defoe.] The History of the Great Plague in London. [Containing references to Epping Forest.] 8vo. London, 1832.

ANON. English Forests and Forest Trees, Historical, Legendary, and Descriptive. 8vo. London, 1853.

ANON. ("Stonehenge.") British Rural Sports. 14th edition. 8vo. London, 1878.

ANON. The Wild Flowers of Repton. 8vo. London, 1866.

ANTIQUARIAN ITINERARY. 3 vols. 8vo. London, 1815—16.

ARCHÆOLOGICAL INSTITUTE OF GREAT BRITAIN AND IRELAND. *Memoirs illustrative of the History and Antiquities of Wiltshire and the City of Salisbury.* 8vo. London, 1851.

BERKELEY, Rev. M. J. *Fungi.* See Cooke, Dr. M. C.

BINGLEY, Rev. W. *Memoirs of British Quadrupeds.* 8vo. London, 1809.

BOTANY, JOURNAL OF. New series. Vol. x. 8vo. London, 1881.

BOWERBANK, J. S. *A History of the Fossil Fruits and Seeds of the London Clay.* 8vo. London, 1840.

BRADY, Sir A. See Davies, William.

BRIGHTWELL, Miss. *A Life of Linnæus.* 8vo. London, 1858.

*BRITTON, JOHN. *The History and Description of Cassiobury Park, Hertfordshire, the Seat of the Earl of Essex.* Folio. London, 1837.

BROWN, Capt. T. *The Book of Butterflies and Moths.* 16mo. London, 1848.

———. See White, Rev. G.

BUCKINGHAMSHIRE ARCHITECTURAL AND ARCHÆOLOGICAL SOCIETY. *Records of Buckinghamshire.* Vols. iii.—iv. 8vo. Aylesbury, 1870.

BUCKLAND, FRANK. *Curiosities of Natural History.* 2nd series. 12mo. London, 1860.

———. *The Natural History of British Fishes.* 8vo. London, 1880.

BUCKLER, G. *Twenty-two of the Churches of Essex, architecturally described and illustrated.* 8vo. London, 1856.

BUFFON. *The Natural History of Quadrupeds.* 8vo. London, 1804.

CHICHESTER AND WEST SUSSEX NATURAL HISTORY AND MICROSCOPICAL SOCIETY. *Reports and Papers.* 8vo. Chichester, 1877—82.

COLEMAN, Rev. W. H. *Flora Hertfordiensis.* See Webb, Rev. R. H.

COOKE, G. A. *Topographical and Statistical Description of the County of Essex.* 24mo. London. [1802—10.]

COOKE, Dr. M. C. *A Fern Book for Everybody.* 8vo. London. [N. D.]

———. *One Thousand Objects for the Microscope.* 8vo. London, 1869.

———. *Rust, Smut, Mildew, and Mould: An Introduction to the Study of Microscopic Fungi.* 4th edition, revised and enlarged. 8vo. London, 1878.

———. *The Woodlands. (Natural History Rambles.)* 8vo. London, 1879.

———, and Rev. J. M. BERKELEY. *Fungi; their Nature, Influence, and Uses.* 2nd edition. 8vo. London, 1875.

COOKESLEY, T. H. See Richter, Prof. T.

COTTON, CHARLES. *The Complete Angler.* See Walton, Isaac.

COX, Rev. T. *Magna Britannia; or Topographical, Historical, Ecclesiastical, and Natural History of Essex.* 4to. London, 1720.

- CRAMPTON, Rev. J. *The Lunar World*. 8vo. Edinburgh, 1863.
- CROUCH, E. A. *An Illustrated Introduction to Lamarck's Conchology*. 4to. London, 1827.
- DARWIN, Dr. C. *The Formation of Vegetable Mould through the action of Worms, with Observations on their Habits*. 5th thousand (corrected). 8vo. London, 1881.
- . *See* Weismann, Dr. A.
- DAVIES, G. C. *See* Walton, Isaac.
- DAVIES, WILLIAM. *Catalogue of the Pleistocene Vertebrata, from the neighbourhood of Ilford, Essex, in the Collection of Sir A. Brady. With an Introduction by Sir A. Brady, and a Description of the Locality, &c., by Henry Woodward and William Davies*. 8vo. London, 1874. (2 copies.)
- DE FONBLANQUE, C. A. *Five Weeks in Iceland*. 8vo. London, 1880.
- DE QUATREFAGES, A. *The Human Species*. 2nd edition. 8vo. London, 1879.
- DERHAM, Rev. Dr. W. *See* Ray, John.
- DORSET NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB. *Proceedings*. Vols. i.—iii. 8vo. Sherborne, 1877—79.
- EDINBURGH GEOLOGICAL SOCIETY. *Transactions*. Vols. i.—iii. Edinburgh, 1870—80.
- ELLIS, Sir H. *See* Norden, John.
- ENGLISH, J. L. *A Manual for the Preservation of the larger Fungi (Hymenomycetes) in their natural condition. Also a new process for the Preservation of Wild Flowers*. 8vo. Epping, 1882.
- ENTOMOLOGICAL SOCIETY. *Proceedings*. 1871—80. 2 vols. 8vo. London, 1872—81.
- ENTOMOLOGIST. Vols. ii.—xiv. 8vo. London, 1864—81.
- ENTOMOLOGIST, WEEKLY. 3 vols. 8vo. London, 1863.
- ENTOMOLOGIST'S MONTHLY MAGAZINE. Vol. xvii. 8vo. London, 1880—81.
- ESSEX FIELD CLUB. *Transactions*. Vol. i. 8vo. Buckhurst Hill, 1881. (2 copies.)
- ESSEX INSTITUTE. *Bulletin*. Vol. xii. 8vo. Salem, Mass., 1881.
- FARN, A. B. *See* Greene, Rev. J.
- FLOWER, W. H. *An Introduction to the Osteology of the Mammalia*. 8vo. London, 1870.
- *GERARDE, JOHN. *The Herball, or Generall Historie of Plantes, gathered by John Gerarde, of London, Master in Chirurgerie; very much Enlarged and Amended by Thomas Johnson, Citizen and Apothecarye of London*. Folio. London, 1636.
- GIBBS, JOHN. *A First Catechism of Botany*. New and enlarged edition. 8vo. Chelmsford. [N. D.] *The Symmetry of Flowers*. *Id.*
- GIBSON, G. S. *The Flora of Essex*. 8vo. London, 1862.

- GLASGOW, NATURAL HISTORY SOCIETY OF. Proceedings. Vol. iv. 8vo. Glasgow, 1881.
- GLASGOW, PHILOSOPHICAL SOCIETY OF. Proceedings. Vol. xii. 8vo. Glasgow, 1881.
- GRAVES, GEORGE. The Naturalist's Pocket-Book, or Tourist's Companion. 8vo. London, 1818.
- GRAY, Dr. J. E. *See* Turton, Dr. W.
- GREENE, Rev. J. The Insect Hunter's Companion. 3rd edition, revised and extended by A. B. Farn. The chapter on Coleoptera by E. Newman. 8vo. London, 1880.
- GROSE, FRANCIS. County Antiquities. Essex. 4to. London. [1783—84.]
- HARTING, J. E. A Handbook of British Birds. 8vo. London, 1872.
- . British Animals Extinct within Historic Times. 8vo. London, 1880.
- . Our Summer Migrants. 2nd edition. 8vo. London, 1877.
- . Rambles in search of Shells, Land and Fresh-water. 8vo. London, 1875.
- . The Ornithology of Shakespeare. 8vo. London, 1871.
- HAVARD, HENRY. The Heart of Holland. Translated by Mrs. Cahel Hoey. 8vo. London, 1880.
- HAYES, ISAAC. An Arctic Boat Journey. Edited by Dr. Norton Shaw. 8vo. London, 1860.
- HOEY, Mrs. C. *See* Havard, Henry.
- HORE, J. P., and EDWARD JEX. The Deterioration of Oyster and Trawl Fisheries of England: its Cause and Remedy. 8vo. London, 1880.
- HUMPHREYS, NOEL. The Genera of British Moths. 8vo. London.
- ILLUSTRATED SCIENTIFIC NEWS. New series. Vol. i. 8vo. New York, 1881.
- INGPEN, ABEL. Manual for the Butterfly Collector. 2nd edition. 24mo. London, 1849.
- JARDINE, Sir W. The Naturalist's Library. Mammalia, 1 vol. Entomology, 5 vols. 8vo. Edinburgh, 1833—1840.
- JEX, EDWARD. Deterioration of Oyster and Trawl Fisheries. *See* Hore, J. P.
- JOHNSON, THOMAS. *See* Gerarde, John.
- KINGSLEY, Rev. C. Glaucus; or the Wonders of the Shore. 6th edition. 8vo. London, 1878.
- KNAGGS, Dr. H. G. The Lepidopterist's Guide. New edition. 5th thousand. 8vo. London. [N. D.]
- LAND AND WATER. [Files of this Journal from 1880 may be consulted.]
- LANKESTER, Dr. E. *See* Ray, John.

- LINDLEY, JOHN. *An Introduction to Botany*. 4th edition. 2 vols. 8vo. London, 1848.
- LORD, W. B. *Crab, Shrimp, and Lobster Lore*. 8vo. London, 1867.
- MCLACHLAN, R. *Instructions for the Collection and Preservation of Neuropterous Insects*. 8vo. London, 1873.
- MANCHESTER GEOLOGICAL SOCIETY. *Transactions*. Vol. xv. 8vo. Manchester, 1880.
- MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY. *Proceedings*. Vols. xvi.—xix. 8vo. Manchester, 1877—80.
- . *Memoirs*. 3rd series. Vol. vi. 8vo. London, 1879.
- MARTYN, THOMAS. *Gardener's and Botanist's Dictionary*. See Miller, Philip.
- MELDOLA, RAPHAEL. See Weismann, Dr. A.
- MIDLAND NATURALIST. Vol. iv. 8vo. London and Birmingham, 1881.
- *MILLER, PHILIP, and THOMAS MARTYN. *The Gardener's and Botanist's Dictionary*. 2 vols. in 4. Folio. London, 1807.
- MOLESWORTH, Miss C., and Miss E. A. ORMEROD. *The Cobham Journals. Abstracts and Summaries of Meteorological and Phenological Observations*. 8vo. London, 1880. (2 copies).
- MOORE, NORMAN. See Waterton, Charles.
- *MOUFFET, THOMAS. *Insectorum sive Minimorum Animalium Theatrum*. Folio. London, 1684.
- *———. *The Theater of Insects, or Lesser Living Creatures*. Folio. London, 1668.
- MURRAY, ANDREW. *Economic Entomology. Aptera*. 8vo. London, 1881.
- NATURAL HISTORY SOCIETY OF NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE, and TYNESIDE NATURALISTS' FIELD CLUB. *Transactions*. Vols. i.—vii. 8vo. London and Newcastle, 1867—80.
- NATURALIST. Vols. i.—ii., vi.—vii. 8vo. London, 1851—52, 1856—7.
- . *New series*. Vol. vi. 8vo. Huddersfield, 1881.
- NATURE. Vols. i.—ii., v.—ix., xix.—xxiv. 8vo. London, 1870, 1872—74, 1879—81.
- NAVE, JOHANN. *A Handy Book to the Collection and Preparation of Fresh-water and Marine Algae, Diatoms, Desmids, Fungi, Lichens, Mosses, &c.* Translated and edited by Rev. W. W. Spicer. 8vo. London, 1869.
- NEWMAN, EDWARD. See Greene, Rev. J.
- NICHOLSON, Dr. H. A. *Introduction to the Study of Biology*. 8vo. Edinburgh and London, 1872.
- NORDEN, JOHN. *Speculi Britanniae Pars: An Historical and Chorographical Description of the County of Essex*. 1594. Edited from the Original MS. by Sir Henry Ellis. (*Camden Society*.) 4to. London, 1840.

NORTH STAFFORDSHIRE NATURALISTS' FIELD CLUB. Reports, 1878—80. 8vo. Newcastle, 1879—81.

OSBOURNE, ELIZABETH. The History of Essex, from the Earliest Period to the Present Time. 4to. London, 1814.

ORMEROD, Miss E. A. A Lecture on Injurious Insects. 8vo. London, 1882.

———. A Manual of Injurious Insects. 8vo. London, 1881.

———. The Cobham Journals. See Molesworth, Miss C.

PONTEY, WILLIAM. The Forest Pruner, or Timber Owner's Assistant. 3rd Edition. 8vo. London, 1810.

PRETCHARD, ANDREW. A History of Infusoria, Living and Fossil. 8vo. London, 1845.

QUEKETT MICROSCOPICAL CLUB. Journal. Vols. iv.—v. 8vo. London, 1874—79.

RAMSAY, A. C. The Physical Geology and Geography of Great Britain. 2nd edition. 8vo. London, 1864.

RAY, JOHN. A Collection of Curious Travels and Voyages. 8vo. London, 1698.

———. Correspondence. Edited by Dr. E. Lankester. (*Ray Society*). 8vo. London, 1848.

———. Select Remains, &c. Edited by Rev. Dr. W. Derham. 8vo. London, 1780.

———. The Wisdom of God manifested in the Works of the Creation. 4th edition. 8vo. London, 1704.

RELEAN, RICHARD. Flora Cantabrigiensis. 3rd edition. 8vo. Cambridge, 1820.

RENNIE, JAMES. A Conspectus of the Butterflies and Moths found in Britain. 16mo. London, 1832.

RICHTER, Prof. T. Plattner's Manual of Qualitative and Quantitative Analysis with the Blowpipe. From the last German edition. Edited by T. H. Cookealey. 8vo. London, 1875.

RIDLEY, Miss M. S. A Pocket Guide to British Ferns. 8vo. London, 1881.

RILEY, Dr. C. V. The Colorado Beetle. 8vo. London, 1877.

ROBINSON, JOHN. The Flora of Essex County, Massachusetts. 8vo. Salem, 1880. Notes on the Woody Plants of Essex County, Massachusetts. *Ib.*, 1879.

ROYAL MICROSCOPICAL SOCIETY. Journal. Vol. iii. 2nd series. Vol. i. 8vo. London, 1880—81.

SCIENCE GOSSIP. Vols. i.—xvii. 8vo. London, 1865—81.

SCOTTISH NATURALIST. Vol. v. 8vo. Edinburgh and London, 1879—80.

- SHAW, Dr. G., and J. F. STEPHENS. General Zoology; or Systematic Natural History. 26 vols. 8vo. 1800—26.
- SHAW, Dr. N. See Hayes, Isaac.
- SMITH, JOHN. Ferns, British and Exotic. 8vo. London, 1866.
- SOMERSETSHIRE ARCHÆOLOGICAL AND NATURAL HISTORY SOCIETY. Proceedings. Vol. xxvi. 8vo. Taunton, 1881.
- SPICER, Rev. W. W. See Nave, Johann.
- STANTON, H. T. June: A Book for the Country in Summer Time. 8vo. London, 1856.
- STEPHENS, J. F. General Zoology. See Shaw, Dr. G.
- . The Nomenclature of British Insects. 2nd edition. 8vo. London, 1838.
- SYMONS, J. Synopsis Plantarum Insulis Britannicis indigenarum. 8vo. London, 1798.
- TAYLOR, Dr. J. E. Flowers: their Origin, Shapes, Perfumes, and Colours. 8vo. London, 1878.
- and Others. Notes on Collecting and Preserving Natural History Objects. 8vo. London, 1876.
- *TOPSELL, EDWARD. The History of Serpents; or the Second Book of Living Creatures. Folio. London, 1658.
- TURTON, Dr. W. Manual of the Land and Fresh-water Shells of the British Islands. New edition, by Dr. J. E. Gray. 8vo. London, 1857.
- TYNESIDE NATURALISTS' FIELD CLUB. Transactions. See Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne.
- WALKER, HENRY. Saturday Afternoon Rambles round London, Rural and Geological. 8vo. London, 1871.
- . The Glacial Drifts of Muswell Hill and Finchley. 8vo. London, 1874.
- WALTON, ISAAC, and CHARLES COTTON. The Complete Angler. New Illustrated edition, with Notes, by G. C. Davies. 8vo. London, [N. D.]
- WALTON, ISAAC. The Compleat Angler; or the Contemplative Man's Recreation. 1653. (Reprint.) 8vo. London, 1872.
- WARNER, RICHARD. Plantæ Woodfordienses. 8vo. London, 1771. (2 copies.)
- WATERTON, CHARLES. Natural History Essays. Edited by Norman Moore. 8vo. London, 1876.
- WATFORD NATURAL HISTORY SOCIETY, and HERTFORDSHIRE FIELD CLUB. Transactions. 2 vols. 8vo. Watford and London, 1878—80.
- WEBB, Rev. R. H., and Rev. W. H. COLEMAN. Flora Hertfordiensis. 12mo. London, 1849.

- WEISMANN, Dr. A. *Studies in the Theory of Descent.* Translated and edited by Raphael Meldola. With a Prefatory Notice by Dr. C. Darwin. 8vo. London, 1882.
- WESTBOFF, H. M. *Pre-historic Phases; or Introductory Essays on Pre-historic Archaeology.* 8vo. London, 1872.
- WHITE, Rev. G. *The Natural History of Selborne; to which are added, the Naturalist's Calendar, Miscellaneous Observations, and Poems.* A new edition. 2 vols. 8vo. London, 1825.
- . *The Natural History of Selborne; with Observations on various parts of Nature, and the Naturalist's Calendar.* Edited by Capt. T. Brown. 5th edition. 8vo. London, 1835.
- WHITE, WILLIAM. *History, Gazetteer, and Directory of the County of Essex.* 2nd edition. 12mo. Sheffield, 1863.
- WILTSHIRE ARCHÆOLOGICAL AND NATURAL HISTORY SOCIETY. *Magazine.* Vol. xix. 8vo. Devizes, 1881.
- WOOD, Rev. J. G., and THEODORE WOOD. *The Field Naturalist's Handbook.* 8vo. London, [N. D.]
- WOOD, SEARLES V. *A Monograph of the Crag Mollusca. Part. i. Univalves. (Palaeontographical Society.)* 4to. London, 1848.
- WOOD, THEODORE. *Field Naturalist's Handbook.* See Wood, Rev. J. G.
- WOODWARD, HENRY. See Davies, William.
- ZOOLOGIST. Vols. xxi.—xxii. 3rd series, vols. i.—v. 8vo. London, 1863—64, and 1877—81.
- PAMPHLETS. Vol. i. Waltham Abbey. 8vo.
- Contents :*
- MAYNARD, JOHN. *The Parish of Waltham Abbey; its History and Antiquities.* London, 1865.
- WINTERS, WILLIAM. *History of the Lady Chapel adjoining the Abbey Church of Waltham Holy Cross.* Waltham Abbey, 1875.
- . *Visitors' Handbook of the Ancient Town of Waltham Holy Cross.* 2nd edition. *Ib.*, 1877.
- PAMPHLETS. Vol. ii. Waltham Abbey. 8vo.
- Contents :*
- WINTERS, WILLIAM. *Biographical Notes on John Foxe, the Martyr-ologist.* Waltham Abbey, 1876.
- . *Select Passages in the Life and Reign of Harold, the last of the Saxon Kings.* *Ib.*
- . *Ecclesiastical Works of the Middle Ages.* *Ib.*, 1877.
- . *Annals of the Clergy of Waltham Holy Cross.* *Ib.*, 1880.
- PAMPHLETS. Vol. iii. Geology. 8vo.
- Contents :*
- BRIGG, JOHN. *The Industrial Geology of Bradford.* Leeds, 1874.
- CLARK, J. E. *Recent Shell Deposits. (Nat. Hist. Journ., 1879.)*
- DALTON, W. H. *A Brief Sketch of the Geology of Colchester. (Essex Stand., 1875.)*
- . *Note on the Range of the Lower Tertiaries of East Suffolk. (Rep. Brit. Assoc., 1880.)*

PAMPHLETS. Vol. iii. Geology. 8vo. (Continued).

Contents :

- DALTON, W. H. Subsidence in East Essex. (*Geol. Mag.*, 1876.)
 ———. The Blackwater Valley, Essex. (*Trans. Essex Field Club*, 1881.)
 FALCONER, Dr. H. On the species of Mastodon and Elephant occurring in the Fossil State in Great Britain. (*Quart. Journ. Geol. Soc.*, 1857.)
 FORDHAM, H. G. On the Importance of Recording Erratic Blocks. (*Trans. Herts. Nat. Hist. Soc.*, 1881.)
 GEOLOGICAL SURVEY OF THE UNITED KINGDOM. Catalogue of Publications. London, 1878.
 RAMSAY, A. C. On the Recurrence of Certain Phenomena in Geological Time. (*Rep. Brit. Assoc.*, 1880.)
 RICKETTS, Dr. C. The Cause of the Glacial Period, with reference to the British Isles. Birkenhead, 1875.
 SWANSTON, WILLIAM, and CHARLES LAPWORTH. On the Silurian Rocks and Graptolites of County Down. (*Proc. Belfast Nat. Field Club*, 1876—77.)
 TIDDEMAN, R. H. Second Report of the Victoria Cave Exploration Committee. (*Rep. Brit. Assoc.*, 1874.)
 WALKER, HENRY. A Day's Elephant Hunting in Essex. (*Trans. Essex Field Club*, 1880.)
 ———. Whitaker's Geological Model of London. (*Geol. Mag.*, 1873.)
 WHITAKER, WILLIAM. List of Works on the Geology, Mineralogy, and Palæontology of Wales (to the end of 1873). (*Rep. Brit. Assoc.*, 1880.)
 ———. List of Works on the Geology of Hertfordshire. (*Trans. Watford Nat. Hist. Soc.*, 1876.)
 ———. Note on the Red Crag. (*Quart. Journ. Geol. Soc.*, 1877.)
 ———. On Subærial Denudation, and on Cliffs and Escarpments of the Chalk and the Lower Tertiary Beds. (*Geol. Mag.*, 1867.)
 ———. On the Cliff-sections of the Tertiary Beds west of Dieppe in Normandy, and at Newhaven in Sussex. (*Quart. Journ. Geol. Soc.*, 1871.)

. Unbound pamphlets, serial publications, &c., which are not available for circulation, are not included in this Catalogue.

LIST OF OFFICERS AND MEMBERS.

(Corrected to March 25th, 1882).

OFFICERS.

Patron.

H.R.H. THE DUKE OF CONNAUGHT & STRATHEARN, K.G.
(Ranger of Epping Forest.)

President.

RAPHAEL MELDOLA, F.R.A.S., F.C.S., F.I.C.

Vice-Presidents.

EDWARD A. FITCH, F.L.S.
RIGHT HON. LORD RAYLEIGH, F.R.S.
N. F. ROBERTS, F.G.S.
REV. W. LINTON WILSON, M.A.

Other Members of Council.

WILLIAM J. ARGENT.
HENRY J. BARNES, F.C.S. (Berlin).
RICHARD L. BARNES, F.C.S.
WILLIAM C. BARNES.
PROF. G. S. BOULGER, F.L.S., F.G.S.
E. N. BUXTON, J.P., Etc. (Verderer of Epping Forest).
JOHN T. CARRINGTON, F.L.S.
ROBERT MILLER CHRISTY.
REV. JAMES FRANCIS, M.A.
GEORGE J. GODWIN.
HERBERT GOSS, F.L.S., F.G.S.
GEORGE C. HARCOURT.
FRANCIS GEORGE HEATH.
J. P. HORE.
ARTHUR LISTER, J.P., F.L.S.
REV. THOMAS W. PEILE.
NATHANIEL POWELL, J.P.
HILDEBRAND RAMSDEN, M.A., F.L.S., F.R.M.S.
W. G. S. SMITH.
CHARLES THOMAS, F.G.S., F.R.M.S.
T. FISHER UNWIN.

Treasurer.

ANDREW JOHNSTON, J.P., D.L. (*Verderer of Epping Forest*),
The Firs, Woodford, Essex.

Secretary.

WILLIAM COLE, Laurel Cottage, Buckhurst Hill, Essex.

Assistant Secretary.

BENJAMIN G. COLE, Laurel College, Buckhurst Hill, Essex.

Librarian.

ALFRED LOCKYER, Stanley Road, Woodford, Essex.

HONORARY MEMBERS.**Date of Election.**

- Jan. 10, 1880. BROWNE, CHARLES, M.A., Barrister-at-law, HONORARY
COUNSEL, 2, Stone-buildings, Lincoln's-inn, W.C.
- „ 22, 1881. COOKE, M. C., M.A., LL.D., A.L.S. (*President of the*
Hackney Microscopical Society), 146, Junction-road, N.
- „ 10, 1880. DARWIN, CHARLES, M.A., LL.D., F.R.S., L. and E., F.L.S.,
F.G.S., &c., Down, Beckenham, Kent.
- „ 22, 1881. HARTING, J. E., F.L.S., F.Z.S., 22, Regent's-park-road,
N.W.
- Feb. 25, 1882. KENT, W. SAVILLE, F.L.S., F.Z.S., F.R.M.S., Aston
House, 87, St. Stephen's-avenue, Shephard's-buagh, W.
- „ 25, 1882. MORRIS, Professor JOHN, M.A., F.G.S., 15, Upper Glou-
cester-place, Dorset-square, N.W.
- „ 22, 1881. PITT-RIVERS, Major-General, F.R.S. (*President of Anthro-*
pological Institute), 4, Grosvenor-gardens, W.
- Jan. 22, 1881. SMITH, WORTHINGTON, G., F.L.S., F.R.H.S., M.A.I., 125,
Grosvenor-road, Highbury, N.
- „ 22, 1881. WALKER, HENRY, F.G.S., 30, Leamington-road-villas,
Westbourne-park, W.
- „ 10, 1880. WALLACE, ALFRED RUSSEL, F.L.S., F.Z.S., Nutwood-cot-
tage, Frith-hill, Godalming, Surrey.
- „ 10, 1880. WHITAKER, WILLIAM, B.A., F.G.S., &c., Her Majesty's
Geological Survey, Jermyn-street, S.W.

ORDINARY MEMBERS.

(*Original Members, registered under Rule VI., are denoted thus * ; Life Members are indicated thus †. Where no county or postal letter is added, Essex is understood. It is particularly requested that early notice of any change of Address be sent to the Honorary Secretary, in order to avoid miscarriage of letters and publications.*)

Date of Election.

- May 29, 1880. * ADAMS, HERBERT J., Roseneath, London-road, Enfield, N.
 * ALCOCK (Miss), The Hall, Sunnyside, Chingford.
 * ALCOCK (Miss), ADA, The Hall, Sunnyside, Chingford.
 * ALLEN, WILLIAM, at 8, Liverpool-terrace, Canning Town, E.
 * ARGENT, W. J., Nightingale-villas, Wanstead.
 * BABINGTON, C. C., M.A., F.R.S., F.L.S., F.G.S., &c. (*Professor of Botany, University of Cambridge*), 5, Brookside, Cambridge.
- Oct. 1, 1881. BAKER, GARRAD, High-street, Chelmsford.
 * BAROLAY (Mrs.), H. F., Woodford.
- Feb. 25, 1882. †BARING, T. C., M.P., J.P., D.L., &c., High Beach, Loughton.
 * BARNES, CHARLES E., Oak Hall, Buckhurst-hill.
 * BARNES (Miss), CLARA, Oak Hall, Buckhurst-hill.
 * BARNES, HENRY J., F.C.S. (Berlin), Oak Hall, Buckhurst-hill.
- Jan. 22, 1881. BARNES (Mrs.), Oak Hall, Buckhurst-hill.
 * BARNES, R. L., F.C.S., Oak Hall, Buckhurst-hill.
 * BARNES, W. C., Oak Hall, Buckhurst-hill.
- Mar. 26, 1881. BAXTER, GEORGE H., Carlton-house, Leytonstone.
- Nov. 26, 1881. BENTLEY, EDWARD J., Bank of England, and 83, Marquess-road, Canonbury, N.
- May 28, 1881. BENTLEY (Miss), MADELINE, 38, Marquess-road, Canonbury, N.
 * BENTON, GEORGE A., Ray-house, Woodford.
 * BILLUPS, T. R., M.E.S., 4, Swiss-villas, Coplestone-road, Peckham, S.E.
- Mar. 26, 1881. BIRD, W. H., 2, Norfolk-villas, Buckhurst-hill.
- Feb. 26, 1881. BLACK, CHARLES, Palmerston-road, Buckhurst-hill.
- Apr. 30, 1881. BLISS, HENRY, "Woodbury," Snaresbrook.
- Aug. 13, 1881. BORRHAM, W. WAKELING, J.P., F.R.A.S., &c., The Mount, Haverhill.
 * BOSCHER, E., M.E.S., Bellevue-house, Twickenham.

- June 26, 1880. BOULGER, Professor G. S., F.L.S., F.G.S., 9, Norfolk-terrace, Bayswater, W.
- * BROOK, GEORGE (Ter.), F.L.S., Fernbrook, Huddersfield.
 - * BROOKE, ARTHUR, F.Z.S., "Brookhurst," North Finchley, Middlesex.
- Jan. 22, 1881. BROOKE, EDWARD, D.L., J.P., Wexham-park, near Slough, Bucks.
- Nov. 27, 1880. BROOKE, GEORGE, Beech-hall, Hale End, Walthamstow.
- Apl. 30, 1881. BROOKER, CHARLES A. B., "The Hollies," Palmerston-road, Buckhurst-hill.
- Aug. 13, 1881. BROWN, EDWARD, Cornwall-villa, Hainault-rd., Leytonstone.
- Mar. 25, 1882. BROWN, JOHN WHITELEY, 1, Carisbrooke-terrace, Hoe-street, Walthamstow.
- Jan. 28, 1882. BROWN, LEONARD A. G., Primrose-hill, Brentwood.
- Mar. 25, 1882. BROWN, WALTER W., Brentwood.
- * BROWNE, COLVILL, F.G.S., &c., 5, Hildrop-road, Camden-road, N., and Scientific Club, Savile-row, W.
 - * BURNBY, GEORGE, Millwall, E.
 - * BURROWS, JOHN, Wanstead.
 - * BUXTON, E. N., J.P., D.L., &c. (*Verderer of Epping Forest*), Knighton, Woodford.
 - * BUXTON, Sir T. FOWELL, Bart., J.P., D.L., &c. (*Verderer of Epping Forest*), Warlies, Waltham Abbey.
 - * BUXTON, T. F. V., Warlies, Waltham Abbey.
 - * CANSDALE, W. D., M.E.S., 3, Dartmouth-villas, Seven Sisters'-road, Stamford-hill, N.
- Aug. 28, 1880. CARLINGFORD, The Right Hon. Lord (*Lord-Lieutenant of Essex*), Dudbrook-house, Navestock.
- * CARRINGTON, JOHN T., F.L.S., M.E.S., Royal Aquarium, Westminster, S.W.
- Oct. 29, 1881. †CECIL, Right Hon. Lord EUSTACE, M.P., &c., 32, Eccleston-square, S.W.
- Mar. 26, 1881. CHALLIS, A. G., The Chestnuts, Buckhurst-hill.
- Apl. 30, 1881. CHAMBERS, JOHN, M.R.C.S., L.S.A., &c., The Lodge, Buckhurst-hill.
- Oct. 1, 1881. CHANCELLOR, FREDERIC, Chelmsford.
- Dec. 18, 1880. CHILTON, HENRY C., Woodford.
- Dec. 18, 1880. CHRISTIAN, WALTER T., 2, Eaton-villas, Loughton.
- * CHRISTY, ROBERT M., Chignal St. James, near Chelmsford.
 - * CLAPHAM (Mrs.), A. H., Woodford-bridge.
 - * CLARKSON, JAMES A., 2, Lime-villas, Derby-road, Woodford.
 - * CLEGG, JOSEPH, M.R.C.S., Epping.
- May 28, 1881. CLIPPINGDALE, SAMUEL D., Powerscroft, Snarebrook.
- Aug. 13, 1881. COCKERELL, Rev. L., M.A., North Weald, near Epping.
- * COLE, BENJAMIN G., Hon. Assistant Secretary, Laurel-cottage, Buckhurst-hill.

- * COLE, HENRY A., Laurel-cottage, Buckhurst-hill.
- * COLE (Miss), Laurel-cottage, Buckhurst-hill.
- * COLE (Miss), JANE E., Laurel-cottage, Buckhurst-hill.
- * COLE, Rev. JOHN F., Roffey Vicarage, Horsham, Sussex.
- * COLE, WILLIAM, M.E.S., HONORARY SECRETARY, Laurel-cottage, Buckhurst-hill.
- May 28, 1881. COLLINGRIDGE, JOHN, "The Elms," Hornsey, N.
- June 25, 1881. COMBS (Miss), JESSIE, 3, Forest-place, Leytonstone.
- Sep. 24, 1881. COOK, JAMES W., Wentworth-house, Snarebrook.
- * COOPER, FRANK W., L.R.C.S. (Edin.), Gainsborough-house, Leytonstone.
- * COOPER, JOHN D., The Hollies, Woodford-green.
- Dec. 18, 1880. COPLAND, CHARLES, C.E., The Park, Kingston-upon-Hull.
- * COPLAND, P. F. (Jnr.), M.E.S., Hillcote, Buckhurst-hill.
- May 28, 1881. CORBLE, GEORGE, Bridge-house, Waltham Abbey.
- * CORDER, HENRY (*Hon. Secretary, Chelmsford Museum*), Grove-house, Great Baddow.
- Mar. 26, 1881. CORY, FREDERIC, M.D., L.R.C.P., M.R.C.S., F.R.G.S., "The Elms," Buckhurst-hill.
- Apl. 30, 1881. CORY, F. W., M.R.C.S., L.S.A., F.M.S., "The Elms," Buckhurst-hill.
- * CRISP, FRANK, LL.B., B.A., F.L.S. (*Secretary to the Royal Microscopical Society*), M.E.S., 5, Lansdowne-road, Notting-hill, W.
- Mar. 25, 1882. CROFT, RICHARD B., Retired Lieutenant R.N., F.L.S., F.R.M.S. (*Hon. Secretary, Hertfordshire Nat. Hist. Soc.*), Fanham's Hall, Ware, Herts.
- * CROUCH, HENRY, F.R.M.S., Grove-hill, Woodford.
- Aug. 28, 1880. CROUCH, WALTER, Grafton-house, Wellealey-road, Wanstead.
- Sep. 25, 1880. CUTTING, WILLIAM M., Elm-house, Loughton.
- Mar. 25, 1882. DAY, GEORGE, 12, The Mount, Whitechapel, E.
- * DEACON, OCTAVIUS, Golding's-hill, Loughton.
- * DEVITT, HENRY, Hillside, Buckhurst-hill.
- Nov. 26, 1881. DOUGLAS, JAMES, Lexford-cottage, Ilford.
- * D'OYLEY, WILLIAM, HONORARY SURVEYOR, Loughton.
- * DUFFIELD, FREDERICK H., 78, Claverton-street, Pimlico, S.W.
- *†DUNNING, J. W., M.A., F.L.S., F.Z.S., 12, Old-square, Lincoln's-inn, W.C.
- Aug. 13, 1881. DURRANT, EDMUND (*Hon. Sec. Chelmsford Museum*), High-street, Chelmsford.
- * DURRANT, W. G., Whitehall-road, Woodford.
- Mar. 26, 1881. EDINGER, W. H., "Rocklands," Palmerston-road, Buckhurst-hill.
- Aug. 13, 1881. EMANUEL, FRANK L., 22, St. Stephen's-square, Bayswater, W.

- * EMERY, W. FRANCIS, 104, Liverpool-road, Islington, N.
- * ENGLISH, JAMES, Epping.
- Aug. 28, 1880. ESSEX, The Right Hon. the Earl of, Cassiobury Park, Watford, Herts.
- Aug. 28, 1880. FAWCETT, WILLIAM, Fern-villa, Maybank-road, Woodford.
- May 29, 1880. FINZI, JOHN, 105, Gower-street, W.C.
- * FISHER, LIONEL P., South-side, Harrow, Middlesex.
- Aug. 28, 1880. FISHER, WILLIAM R., M.A., Barrister-at-law, South-side, Harrow, Middlesex.
- * FITCH, EDWARD A., F.L.S. (*Secretary to the Entomological Society*), VICE-PRESIDENT, Brick-house, Maldon.
- * FORBES, WILLIAM P., Evergreen-lodge, Wanstead.
- * FORSTER, WILLIAM, East Lenham-lodge, Cleveland-road, Wanstead.
- Aug. 13, 1881. FORWARD, F. H., Stanford-le-Hope.
- * FOWLER, WILLIAM, J.P., Forest-house, Leytonstone.
- * FRANCIS, Rev. JAMES, M.A., Vicarage, Waltham Holy Cross.
- * FRANCIS, WILLIAM, Ph.D., F.L.S., F.G.S., F.C.S., F.R.A.S., Red Lion-court, Fleet-street, E.C.; and The Manor-house, Richmond, Surrey.
- July 24, 1880. FRIEWELL, RICHARD J., F.C.S., F.I.C., 10, Clapton-square, Lower Clapton, E.
- June 25, 1881. GARDNER, PERCY, M.A., F.S.A. (*Disney Professor of Archaeology, Cambridge*), 4, Whitehall-lane, Woodford.
- * GARDNER, SAMUEL, 5, Whitehall-lane, Woodford.
- * GARDNER, THOMAS, Oak-lea, Whitehall-road, Woodford.
- May 29, 1880. GAWLER, JOHN M., Spencer-house, Atherton-road, Forest-gate.
- Aug. 28, 1880. GEORGE, WILLIAM, 19, Church-crescent, South Hackney, N.E.
- * GIBBS, JOHN, Writtle-road, Chelmsford.
- May 28, 1881. GIBSON, GEORGE STACEY, F.L.S., Saffron Walden.
- May 29, 1880. GLASS, CHARLES J., Bocking-house, Walthamstow.
- * GODWIN, GEORGE J., 4, St. John's-villas, Buckhurst-hill.
- * GODWIN (Mrs.), 4, St. John's-villas, Buckhurst-hill.
- * GOMM, WILLIAM H., The Green, Somerton, Somerset.
- * GORDON, FREDERICK, Bentley-priory, Great Stanmore, Middlesex.
- * GOSS, HERBERT, F.L.S., F.G.S., M.E.S., The Avenue, Surbiton-hill, Surrey.
- Feb. 25, 1882. GOULD, CHALKLEY, Traps-Hill-house, Loughton.
- * GOULD, F. C., 10, Knighton-villas, Buckhurst-hill.
- Aug. 13, 1881. GOULD, GEORGE W., Champion's-hill, Loughton.
- Dec. 17, 1881. GREEN, R. B., Clifton-cottage, Cleveland-road, Snaresbrook.

- * GRUT, FERDINAND, F.L.S. (*Librarian to the Entomological Society*), 9, King-street, Southwark, S.E.
- Feb. 25, 1882. GURNEY, J. H. (Jun.), F.Z.S., Northrepps-hall, Norwich.
- Sep. 24, 1881. HALFORD, BERNHARD F., B.Sc., &c., 26, Cleveland-gardens, Hyde-park, W.
- * HALSBY, WILLIAM, 3, Mornington-road, Woodford.
- * HARCOURT, GEORGE C., 34, Wellesley-road, Wanstead.
- Oct. 1, 1881. HAROLD, FREDERICK R., F.S.S., 19, Lambton-road, Hornsey-rise, N.
- * HARPER, AUGUSTUS, Lomsenheim, Cleveland-road, Wanstead.
- Mar. 26, 1881. HARRISON, FRANCIS G., Crown-hotel, Loughton.
- * HART, F. G., Canes, near Harlow.
- Feb. 25, 1882. HARWOOD, W. H., Colchester.
- * HEATH, FRANCIS G., Brunswick Lodge, South Hackney, N.E.
- July 24, 1880. HEATHFIELD, ERNEST, Snakes-lane, Woodford.
- Oct. 1, 1881. HEMPLEMAN, F. H., Cleveland-lodge, Wanstead.
- * HENTY, ROBERT, Nazing-park, Waltham Cross.
- * HODGE (Miss), CATHERINE L., Magdala-house, Buckhurst-hill.
- * HODGE (Miss), MARY, Magdala-house, Buckhurst-hill.
- * HODGE, SAMUEL W., Magdala-house, Buckhurst-hill.
- * HOOPER, BASIL M., 2, Albert-villas, Whitehall-road, Woodford.
- * HOOPER, HORACE B., Roden-house, Abridge.
- * HORN, J. P., 40, Bloomsbury-street, Bedford-square, W.C.
- * HOWARD, DAVID, F.C.S. (*President of the Walthamstow Nat. Hist. Soc.*), Rectory-manor, Walthamstow.
- * HOWARD, JOHN ELIOT, F.R.S., F.L.S., Lord's Meade, Tottenham, N.
- * HOWARD, WILLIAM C., North-side, Tottenham, N.
- * HOWARD, W. DILLWORTH, City Mills, Stratford.
- Apr. 30, 1881. HUGHES, REV. ALBERT, M.A., The Rectory, Woodford.
- * HUTCHINSON, JOHN, Fairlight, Palmerston-road, Buckhurst-hill.
- Feb. 26, 1881. HUTCHINSON, RICHARD, Woodford Wells.
- * HUTCHISON, W. D.
- Sep. 25, 1880. HUTCHISON, W. E., 9, Hill-street, Clapton, E.
- June 25, 1881. JACKSON, REV. E. S., Buckhurst-hill.
- Oct. 1, 1881. JAMES, F. J. VALLANCE, 82, Cambridge-street, Eccleston-square, W.
- Dec. 18, 1880. JERVOISE, SIR J. CLARKE, Bart., Idsworth-park, Horndean, Hants.
- * JOHNSTON, ANDREW, J.P., D.L., &c. (*Verderer of Epping Forest*), HONORARY TREASURER, The Firs, Woodford.

- Aug. 28, 1880. JONES, D. B., Elm-view, Middle-lane, Hornsey, N.
 Oct. 1, 1881. JONES, GEORGE T., M.D., The Laurels, Loughton.
 Sep. 25, 1880. KELL, E. DELACOURT, Holland-house, Spring-grove, near Isleworth.
- * KELLY, ALEXANDER, Sprigg's Oak, Epping.
 - * KELLY (Mrs.), Sprigg's Oak, Epping.
 - * KELLY (Miss), CATHERINE, Aubrey-house, Woodford.
 - * KING, JOSEPH E. S., 16, North-buildings, Finsbury-circus, E.C.
 - * KING (Mrs.), 37, Arundel-square, Barnsbury, N.
- Apl. 30, 1881. KING, THOMAS, Westbury-house, Buckhurst-hill.
 * KINGDON, REV. H. J., M.A.
- June 25, 1881. LATTER, W. J., Mus.B., R.A.M., Woodford.
 Feb. 25, 1882. LAVER, HENRY, M.R.C.S., F.L.S. (*Hon. Sec. Colchester Nat. Hist. Soc.*), Colchester.
- Apl. 30, 1881. LAWSON, JAMES W., 104, Shrubland-grove, Dalston, E.
 Sep. 24, 1881. †LEAF, CHARLES J., F.L.S., F.G.S., F.R.M.S., F.S.A., Old Change, E.C., and Pain's-hill, Cobham, Surrey.
- Aug. 28, 1880. LEEMAN, REV. ALFRED, M.A., Starling-lodge, Buckhurst-hill.
- * LETCHFORD, R., F.R.M.S., Prospect-house, Woodford.
 - * LINDSAY, R. B.
 - * LISTER, ARTHUR, J.P., F.L.S., Leytonstone.
- Mar. 26, 1881. LIVINGSTON, CLERMONT, M.E.S., East-lodge, Forest-rise, Walthamstow.
- Apl. 30, 1881. LOCKET, GEORGE C., Highwood-house, Mill-hill, Hendon, Middlesex.
- * LOCKYER, ALFRED, HONORARY LIBRARIAN, Stanley-road, Woodford.
 - * LOCKYER, BERNARD, 33, Freegrove-road, Holloway, N.
- Nov. 27, 1880. LOCKYER, F. T., Raleigh, North Carolina, United States.
 * LOCKYER, G. H., Tavistock-road, Snaresbrook.
- Aug. 13, 1881. LOWNDES, GEORGE ALAN, M.A., J.P., D.L., Barrington Hall, Hatfield Broad Oak, near Harlow.
- * LUBBOCK, SIR JOHN, Bart., D.C.L., LL.D., M.P., F.R.S., F.G.S. (*President British Association*), High Elms, Farnborough, Kent.
- May 28, 1881. MACDONALD, D. G. F., J.P., LL.D., C.E., 61, Hugh-street, Eccleston-square, S.W.
- * MACMURDO, WALTER GEORGE, Beechmont, Palmerston-road, Buckhurst-hill.
- July 24, 1880. MACKONCHIE, WILLIAM, St. Mary's Hospital, Paddington.
 Apl. 30, 1881. MAITLAND, REV. A. GRAY, F.R.G.S., Church-end, Woodford.
- * MAKINS, Colonel, M.A., M.P., J.P., D.L., Prince's-gate, S.W.
- Sep. 24, 1881. MARSHALL (Mrs.), Epping New-road, Buckhurst-hill.

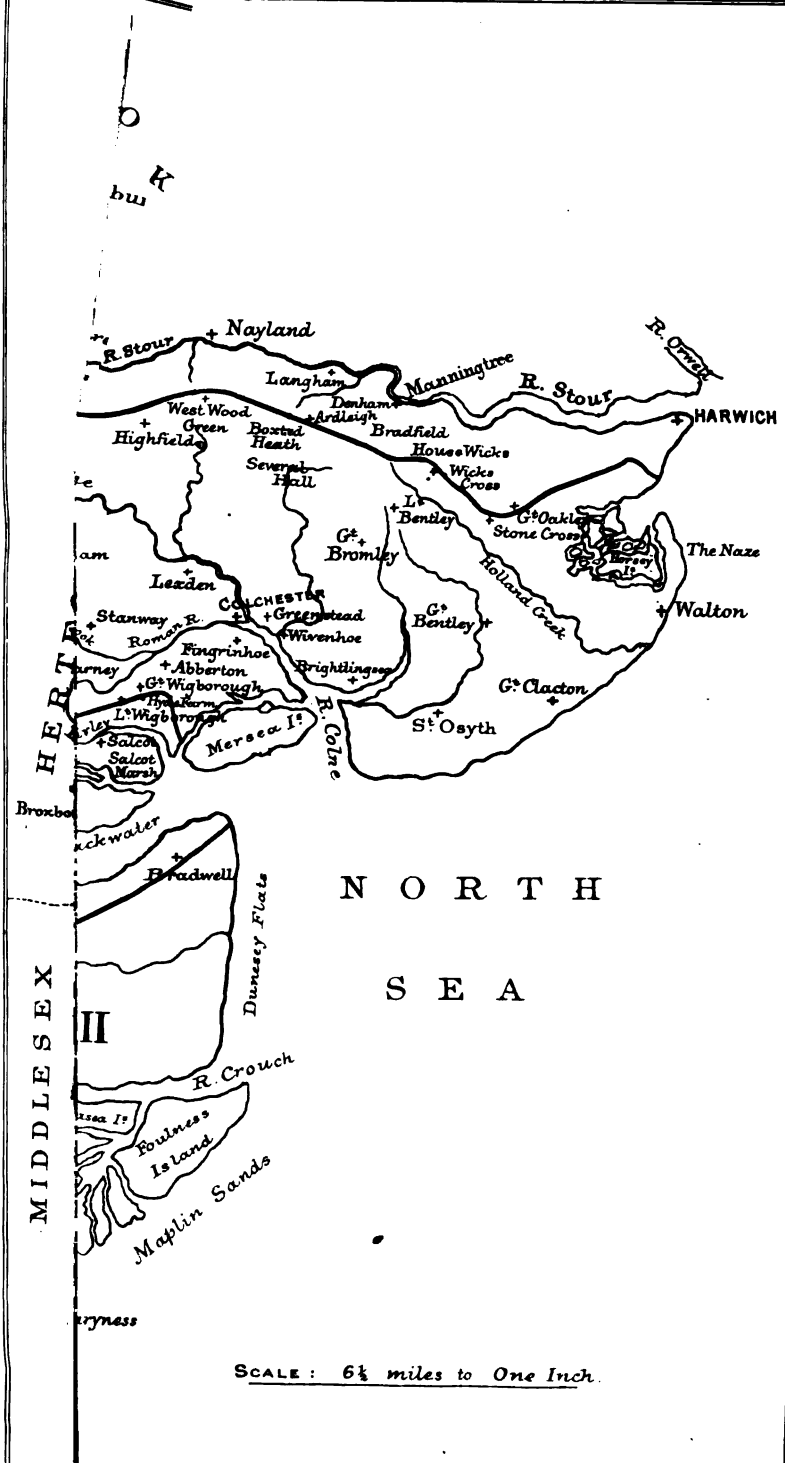
- Oct. 1, 1881. MARSHAM, CHARLES A. ONLEY, J.P., Sandon, near Chelmsford.
- Aug. 28, 1880. MARTIN, EDWARD, B.A., Barrister-at-law, F.Z.S., Union Bank Chambers, Carey-street, Lincoln's-inn, W.C.
- July 24, 1880. MARTIN, WALTER E., 3, Mornington-villas, Mornington-road, Woodford.
- Feb. 25, 1882. MAWER, WALTER, F.G.S., 37, Norfolk-street, Strand, W.C.
- * MCKENZIE, ALEXANDER (Captain Hon. Artillery Company), Superintendent of Epping Forest, Warren-house, Loughton.
- * MCKENZIE, JOHN A., F.R.M.S., Ferrestone-lodge, Hornsey, N.
- Sep. 24, 1881. MEGGY, F. H., Chelmsford.
- June 25, 1881. MELDOLA (Mrs.), 21, John-street, Bedford-row, W.C.
- * MELDOLA, RAPHAEL, F.R.A.S., F.C.S., M.P.S., F.I.C., &c., PRESIDENT, 21, John-street, Bedford-row, W.C.
- *† MELLIS, WILLIAM, F.L.S., Sewardstone-lodge, Sewardstone.
- * MIALI (Miss), Darwen-house, Buckhurst-hill.
- * MILDRED (Mrs.), Chigwell.
- Dec. 18, 1880. MILLER, JAMES, Woodford Walls.
- Feb. 25, 1882. MORGAN, D. J. (*Verderer of Epping Forest*), Blake Hall, Wanstead.
- Nov. 27, 1880. MORTEN, THOMAS S., 42, Haverstock-hill, N. W.
- May 28, 1881. MUNRO, Major R. V., White Hall, Chigwell-row.
- Apl. 30, 1881. NEWLING, BENJAMIN, Percy-lodge, Wanstead.
- Sep. 24, 1881. NEWMAN, FREDERICK G., Belgrave-villa, Woodford.
- June 25, 1881. NOBLE, GEORGE R., Woodford-bridge.
- * OLDHAM, CHARLES, 2, Warwick-villas, Chelmsford-road, Woodford.
- Sep. 24, 1881. OLIPHANT, FREDERICK, Chelmsford.
- Aug. 28, 1880. ORMEROD (Miss), ELEANOR A., F.M.S., M.E.S., Dunster-lodge, Spring-grove, Isleworth.
- * OWEN, JOHN, 320, Old-street, E.C.
- * OXLEY, FREDERICK, F.R.M.S., &c., Woodford, and 8, Crosby-square, E.C.
- Nov. 27, 1880. PARKER, CHARLES J., Rosalyn-villa, Snaresbrook.
- * PARKER, JAMES F., 6, Adelaide-terrace, Ilford.
- Nov. 26, 1881. PEARCE, CHARLES T., M.D., M.R.C.S., Prince's-road, Buckhurst-hill.
- Nov. 27, 1880. PEILE, Rev. THOMAS W., Rectory, Buckhurst-hill.
- Mar. 26, 1881. PERRY (Mrs.), Ferndale, Buckhurst-hill.
- Mar. 26, 1881. PERRY, GEORGE, Ferndale, Buckhurst-hill.
- Mar. 25, 1882. POWELL (Miss), EMMA SOPHIA, Buckhurst-hill.
- * POWELL, NATHANIEL, J.P., D.L., Buckhurst-hill.
- Feb. 26, 1881. PRATT, BENJAMIN, Snake's-lane, Woodford.
- Aug. 28, 1880. PRIEST, ARTHUR, M.D., Waltham Abbey.

- July 24, 1880. PRINCE, CHARLES E., M.R.C.S., Buckhurst-hill.
 *†RAMSDEN, HILDEBRAND, M.A., F.L.S., F.R.M.S., 26, Upper Bedford-place, Russell-square, W.C.
 * RAYLEIGH, The Right Hon. Lord, M.A., F.R.S., &c. (*Professor of Experimental Physics, University of Cambridge*), VICE-PRESIDENT, Terling-place, Witham, and 5, Salisbury-villas, Cambridge.
- Oct. 1, 1881. RAYNOR, GILBERT H., M.A., Hazeleigh Rectory, Maldon.
- Aug. 28, 1880. †REAY, The Right Hon. Lord, D.C.L., F.R.G.S., &c. (*President Social Science Congress*), 6, Great Stanhope-street, Mayfair, W.
- Sep. 24, 1881. REES, GEORGE, "Oakhurst," Chigwell.
- July 24, 1880. REEVES, LUTHER, Prospect-cottage, George-lane, Woodford.
- June 25, 1881. REID, GEORGE T., Tuiling-cottages, Beulah-road, Walthamstow.
- Feb. 25, 1881. REID, J. L., St. Kilda-villas, Buckhurst-hill.
- Nov. 27, 1880. RICHARDSON, EDWIN, 289A, King's-road, Chelsea, S.W.
- Oct. 29, 1881. RIDLEY (Miss), MARIAN, 7, Cambridge-square, W.C., and Hollington-house, Newbury, Hants.
 * ROBERTS, N. F., F.G.S., VICE-PRESIDENT, Rosebrae, Glen-gall-road, Woodford.
 * ROBERTS, SYDNEY, Stamford-hill, N.
 * RODWELL, Rev. R. M., M.A., Rectory, High Laver.
- June 25, 1881. ROSS, W. J. CLUNIES, B.Sc. (*Lond.*), F.G.S., &c., 4, Trinity-terrace, Bow, E.
- Aug. 28, 1880. ROSSLYN, The Right Hon. the Earl of, M.A., F.Z.S., Easton-lodge, Dunmow.
 * RUSSELL, Rev. A. F., M.A., Rectory, Chingford.
- Jan. 22, 1881. RUSSELL, Lieut.-Col., J.P., D.L., Stubbers, Romford.
 * SAUL, DAVID H., Dover-house, Fairlop-road, Leytonstone.
 * SAWARD, WILLIAM, Epping.
- Oct. 29, 1881. †SELWIN-IBBETSON, Sir H. J., Bart., M.A., M.P., J.P., D.L., &c., Down Hall, Harlow, and 16, James-street, Buckingham-gate, W.
- Nov. 26, 1881. SHEENSTONE, J. C., F.R.M.S., Colchester.
 * SHIPLEY, ARTHUR E., Springfield, Windsor, Berks.
- Mar. 25, 1882. SHREWSBURY, A. W., Forest-house, Woodford.
- June 25, 1881. †SMITH, GRIFFITHS, F.R.G.S., Widdington, Newport, Essex.
- May 29, 1880. SMITH (Mrs.), MARY, Woolpits, Great Saling.
- Jan. 22, 1881. SMITH, SAMUEL, 331, Hackney-road, N.E.
 * SMITH, SIDNEY, Tavistock-villa, Lea-bridge-road, Leyton.
 * SMITH, W. G. S. (*Hon. Sec. "Forest Fund"*), Rose-cottage, Forest Gate.
 * SMITHER, WILLIAM, Woodford Wells.
 * SMOOTHY, CHARLES, Bexfields Farm, Galleywood, Chelmsford.

- Jan. 22, 1881.* SNELL, EDWARD A., M.B., &c., 70, City-road, E.C.
 * SPICER, ALBERT, Woodford.
- Nov. 27, 1880. SPICER (Miss) ELLEN, "Harts," Woodford.
 * SPICER, GEORGE, "Dunraven," The Ridgeway, Enfield, Middlesex.
- Aug. 13, 1881. SPICER, HENRY, B.A., F.L.S., F.G.S., 14, Aberdeen-park, Highbury, N.
 * SPILLER, JOHN, F.C.S., 2, St. Mary's-road, Canonbury, N.
 * SPILLER, WILLIAM, F.C.S., Fitzjohn's-avenue, Hampstead, N.W.
- Mar. 26, 1881. SPRING, HENRY, Woodford Wells.
 * STABLE, ROBERT S., Cleveland-road, Wanstead.
 * STANTON, H. T., F.R.S., F.L.S., F.G.S. (*President of the Entomological Society*), Mountsfield, Lewisham, S.E.
- Oct. 1, 1881. STEAD, W. H., Hexham-house, York-road, Birkdale, Southport, Lancashire.
- June 25, 1881. STEAR, HENRY, M.R.C.S., Saffron Walden.
 * STEPHENS, R. DARELL S., F.L.S., F.G.S., F.Z.S., Bradpole, Bridport, Dorset.
 * STEVENS, WILLIAM, The Green, Woodford.
- Jan. 22, 1881. STEWART, FREDERICK.
- June 25, 1881. STRINGER, EDWIN T., Princes-road, Buckhurst-hill.
 * SWALLOW, REV. R. D., M.A., Grammar-school, Chigwell.
 * SWORDER, CHARLES B., Woodlands, Epping.
 * SWORDER, WALTER, 1, Blandford-villas, Queen's-road, Buckhurst-hill.
- May 28, 1881. TABBUM, BURNETT, Margaretting-lodge, Leytonstone.
 * TAYLOR, THOMAS P., M.R.C.S., L.A.C., F.R.M.S., Essex and Colchester Hospital, Colchester.
- May 29, 1880. †THOMAS, CHARLES, F.G.S., F.R.M.S., Clarendon-house, Buckhurst-hill.
- Jan. 22, 1881. THOMASIN, JAMES G., St. Ann's, Hendon, Middlesex.
- Jan. 22, 1881. THOMASIN (Mrs.), J. G., St. Ann's Hendon, Middlesex.
 * THOMPSON, A., 60, East India-road, Poplar, E.
- June 26, 1880. THOMPSON, ERNEST E., 66, Albany-street, Regent's-park, W.
- July 24, 1880. THOMPSON, ROBERT M. BIRD, Walden-hall, Saffron Walden.
- Nov. 27, 1880. THORP, WILLIAM, B.Sc., F.C.S., F.I.C., 39, Sandringham-road, Kingsland, E.
- May 28, 1881. TILL, JOHN SMYTH, "The Laurels," Palmerston-road, Buckhurst-hill.
- Feb. 26, 1881. TOZER, AUGUSTUS H., White Hall-lane, Buckhurst-hill.
 * TOZER, EDWARD, Woodford.
- June 26, 1880. TRAVIS, J., Saffron Walden.
 * TRIMMER, FRANCIS, M.D., Forest Gate.

- Aug. 28, 1880. TURNER, W. PICKETT, M.R.C.S., Lancaster-terrace, Leytonstone.
- * TWEED, WALTER, Epping.
- Oct. 29, 1881. UNWIN, EDWARD, "Rosedale," Hendon-road, Les, Kent.
- June 25, 1881. UNWIN, GEORGE, Chilworth, Surrey.
- * UNWIN, T. FISHER, 19, Southampton-street, Bloomsbury-square, W.C.
- Dec. 17, 1881. VARENNE, E. G., M.R.C.S., Kelvedon.
- Nov. 27, 1880. VARLEY, FREDERICK H., F.R.A.S., M.P.S., Mildmay-avenue, Highbury, N.
- * VAUGHAN, HOWARD, M.E.S., 11, Ospringe-road, Brecknock-road, N.W.
- * VINCENT, RALPH, Leytonstone.
- * WAREFIELD, W. T., Farm-hill, Waltham Abbey.
- June 26, 1880. WALKER, Rev. F. A., B.D., F.L.S., Elm-hall, Wanstead.
- June 25, 1881. WALL, PHILIP W., M.Inst.C.E., F.G.S., Clevedon, Somersetshire.
- June 26, 1880. WALLER, JOHN, 5, Talbot-road, Tottenham, N.
- Aug. 28, 1880. † WALSINGHAM, Lord, M.A., F.Z.S., M.E.S., Eaton-house, Eaton-square, S.W.
- May 28, 1881. WARBURG (Mrs.), 11, Upper Bedford-place, Russell-square, W.C.
- Sep. 24, 1881. WARBURG, SIMON, 52, Doughty-street, Mecklenburgh-square, W.C.
- Aug. 18, 1881. WARBURG (Mrs.), S., 52, Doughty-street, Mecklenburgh-square, W.C.
- Sep. 24, 1881. WARNER, COMPTON, "The Rookery," George-lane, Woodford.
- May 28, 1881. WELLER, GEORGE, M.R.C.S., The Mall, Wanstead.
- Nov. 27, 1880. WELLS, FRANK B., 25, Lorne-road, Finsbury-park, N.
- June 25, 1881. WESTHORN, T., Loughton.
- Nov. 27, 1880. WHEELER, E., Whitehall-road, Woodford.
- * WHITBOURN (Miss), Darwen-house, Buckhurst-hill.
- * WHITE, WILLIAM, Morden-house, 55, Highbury-hill, N.
- Mar. 25, 1882. WILKINSON, HENRY M., 25, Blandford-square, Marylebone, N.W.
- Nov. 26, 1881. WILLIAMS, C. GREVILLE, F.R.S., F.C.S., 6, St. Stephen's-villas, St. Stephen's-road, Hounslow.
- Apl. 30, 1881. WILLIAMS, M. WHITELEY, F.C.S., F.I.C., 18, Kampsford-gardens, S.W.
- * WILSON, Rev. W. LINTON, M.A., VICE-PRESIDENT, "Oak-hurst," Chigwell.
- * † WINSTONE, BENJAMIN, M.R.C.S., Ockeridge, Epping; and 53, Russell-square, W.C.
- June 25, 1881. WINTER (Mrs.), LEWIS, "Clements," Snarresbrook.
- Feb. 25, 1882. WIRE, ALFRED P., 13, Mornington-terrace, Leytonstone.

- June 25, 1881. WRIGHT, Rev. A. B. BINGHAM, M.A., Stebbing Vicarage,
Chelmsford.
- June 26, 1880. WRIGHT, W. H., Oakburn, New-road, Buckhurst-hill.
- Jan. 22, 1880. WRIGHT, Rev. W. J., B.A.
- * YEATES (Mrs.), Erin-villa, Buckhurst-hill.
- Mar. 26, 1881. YORSTON, A. J., "The Hollies," Palmerston-road, Buck-
hurst-hill.
- * YOUNG, FREDERICK, J.P., &c. (*President "Forest Fund"*),
5, Queensberry-place, Queen's-gate, S.W.



SCALE: 6 1/2 miles to One Inch.

